

**High Energy Astrophysics Research
and Programmatic Support
Contract No. NAS5-32490**

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Technical Report
for
January 1, 1994 through March 31, 1994

**NASA/Goddard Space Flight Center
Contracts Office
Mail Code 286
Greenbelt, Maryland 20771**

by

**Universities Space Research Association
Mail Code 610.3
Building #26, Room 215
NASA/Goddard Space Flight Center
Greenbelt, Maryland 20771**



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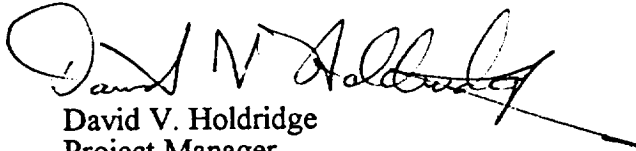
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Enclosed is a copy(ies) of the Technical Report for the USRA/Goddard Visiting Scientists Program under contract NAS5-32490 for the period of January 1, 1994 through March 31, 1994.

If you have any questions, please don't hesitate to contact us.



David V. Holdridge
Project Manager

**May 6, 1994
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**Subject: Enclosed is the Technical Report for the Period
January 1, 1994 - March 31, 1994**

**High Energy Astrophysics Research
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Technical Report

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**Brief Summary of Task Activities under Contract NAS5-32490 During the Period of
January 1, 1994 through March 31, 1994**

(Individual Project Reports are attached on the indicated pages)

Summary notation and actual reports are sequentially listed by Task Number

SPACE SCIENCES

<u>Page #</u>	<u>Task Number</u>	
1	<u>93-01-00</u>	Angelini completed a new release of the softwares XRONOS and XIMAGE as well as archiving in the optical jukebox of all the EXOSAT data, which is about 150 Gbytes of data. The archiving of the EXOSAT calibration information has been initiated. She also conducted the analysis of her ROSAT data of the X-ray pulsar X1626-67 and the PV data obtained with ASCA for the same source.
4		Drake continued to coordinate the debugging and enhancement of the HEASARC's database access system XOBSEVER/BROWSE on its Ultrix based LEGACY computer. In addition, he also started working on a project to make a FITS database out of the Einstein MPC database and assisted in the preparation and submission of two ASCA AO-2 proposals for which he was a co-investigator. Dr. Drake has had a total of six papers either accepted for publication or that await acceptance.
7		George worked on the maintenance and development of the OGIP Calibration Database and completed the introduction of OGIP-developed Dynamic Memory Allocation routines so as to greatly reduce the memory requirements of the FTOOLS package within the IRAF environment. Dr. George also researched in cooperation with other collaborators to create a paper near completion arising from ROSAT PSPC AO-1 observations of the Seyfert 1 galaxy Mrk 841 and has had seven papers published.
13		Whitlock finalized the Vela 5B and Ariel 5 database products created and put into the HEASARC on-line services. She provided user support for the on-line Vela 5B, Ariel 5 and HEAO 1 databases. In addition, she completed making the 8mm duplicates of the data sets salvaged from the basement last year and has had one paper submitted for publication and two others printed.

Page # **Task Number**

- 15 **93-02-00** **Corcoran** supervised the data ingest of the ROSAT public archive into the NDADS archive and responded to a total of 329 email communications. He also continued his work on the rationalized FITS development for ROSAT as supervisor and completed the Appendix to the ROSAT Data Product Guides concerning the RDF formatted files. Dr. Corcoran submitted four proposals for ASCA AO2 and had two papers accepted for publication.
- 17 **Snowden** made preparations for public release software for the analysis of ROSAT PSPC observations of extended sources and the diffuse X-ray background and have converted a package of thirteen programs to operation on the more widely used UNIX operating system machines. He researched and had accepted his lead-author paper for publication and submitted a ROSAT AO-5 proposal for mosaic of HRI pointings of the SMC.
- 19 **Turner** significantly updated all the ROSAT "Frequently Asked Questions" files and worked on ensuring that the forthcoming ROSAT RDF format files will be readable in the ASCA analysis system XSELECT. She also worked on filling out some ROSAT information pages for the World Wide Web. Her AGN Science efforts concentrated on ASCA observations of NGC3783 and the Mkn841 multi-waveband monitoring campaign.
- 21 **93-03-00** **Day** assumed the responsibility for overseeing the insertion of documents into the ASCA home page on the World Wide Web and finished writing the ASCDA Getting Started Guide. He continued to: 1) write, edit and compile the new issue of the "ABC Guide to ASCA Data Reduction", 2) coordinate and participate in the advising of US ASCA PIs on how their AO-1 observations should be carried out and 3) coordinate and participate in the help given ASCA Guest Observers who visit the Guest Observer Facility at GSFC. Dr. Day co-authored a paper submitted for publication and submitted two ASCA AO-2 proposals as PI and four as Co-I.
- 22 **Ebisawa** helped to make observation plans for six US ASCA Guest Observers' observations and worked at ISAS, Japan to develop and test ASCA data analysis systems. In addition, he made the ASCA GIS response data files for ASCA Guest Observers' use as well as the ASCA GIS bank sky background database for ASCA Guest Observers to carry out GIS background subtraction. Dr. Ebisawa had two proposals submitted, a paper published and another accepted for publication.

Page # **Task Number**

- 23 **93-03-00** **Mukai** acted as the GOF duty scientist on two separate occasions, helping the GOs plan the details of their ASCA observations and participated in the booth activity to publicize ASCA in general to answer questions about ASCA and related software. He reviewed approximately 60 proposals to judge their technical feasibility and had two papers accepted for publication.
(cont.)
- 24 **93-04-00** **Lochner** showed continued progress in developing new software for OGIP's FTOOLS package and initiating the organization of the technical appendix for the XTE NASA Research Announcement to be released later this year for the Guest Observer Facility (GOF) for the X-ray Timing Explorer (XTE). He also assisted the completion of the Interface Control Document (ICD) and developed FITS file formats for the data files in the ASLM archive database as well as four new routines for OGIP's FTOOLS package.
- 26 **Rots** participated in the completion of providing the first production version of the "Build 2a" version of XFF and update of XFF documentation. He also assisted in the completion of the design of the Data Description Language (DDL) and produced more sets of data descriptors and template FITS files for various instruments and modes. A separate documents was produced which unites all the special FITS conventions used in the XTE context. Dr. Rots also resumed his analysis of the ROSAT data on NGC 1961 again this quarter.
- 29 **Schlegel** made preparations for publication the proceedings of the ROSAT Science Symposium and joined the X-ray Timing Explorer project. Research efforts were devoted to upper limits on the γ -ray emitters, the examination of databases on the dwarf novae VW Hyi and Z Cha, and the analysis of the ROSAT PSPC data on SN1978K in NGC1313. Related papers are near completion.
- 32 **Smale** made preparations for demonstrations to the XTE Project of the software from XTE Build 2 and showed various FTOOLS, using data that came out of the FITS formatter (XFF). He also worked on the Mission Planning interface between the GOF and the SOF and analyzed the PV observations of the X-ray binaries X1820-303, X1822-371 and X1916-053. He prepared and submitted three proposals for the next round of ASCA observations.

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- 35 **93-05-00** **Giles** continued to serve as the Software Manager for the PCA experiment software development and deliveries to the XTE Science Operations Center. He also continued to support the Goddard team, developing the PCA detectors for the XTE satellite. He also is continuing to serve as the chairman of a search committee, which assesses candidates for a scientist position on the XTE program in the PCA group. Dr. Giles has updated and/or enhanced approximately ten papers regarding PCA and various research issues.
- 38 **Zhang** identified the problem and devised a solution in the detector performance evaluation. He designed a scanner system to systematically scan every centimeter of the detector wires. He also wrote most of the software needed to process the data collected from the scanner. In addition, he reviewed the uniformity of five of the six XTE/PCA proportional counters and made necessary precautions to ensure the accuracy of the XTE's clock for the end-end timing test for the entire system. Two papers and proposals for the XTE/PCA observations are in the works.
- 40 **93-06-00** **Chen** submitted a research proposal to ASCA AO-2, another to ROSAT, and two more to Compton GRO Cycle 4. He also was involved in the creation of two poster papers that were presented at the 183rd AAS Meeting and had a paper accepted for publication.
- 41 **93-07-00** **Christian** served as the system manager for the new UNIX computer system the group has bought for use in IMAX and ISOMAX data analysis. He worked on the data analysis, writing and editing of a paper for ALICE (A Large Isotopic Composition Experiment). He was responsible for the energy loss measurement in four scintillation counters for IMAX (Isotope Matter-Antimatter eXperiment) as well as onboard command and data handling system and ground equipment for ISOMAX, another magnetic spectrometer balloon experiment. For ACE (Advanced Composition Explorer), Dr. Christian was the Assistant to the Project Scientist and a member of the science team for two of the instruments onboard.
- 44 **93-08-00** **Schaefer** continued routine work of regular data processing for the BATSE detectors. This included scientific analysis, data archiving, answering questions to non-BATSE team members, refereeing papers and writing papers. His analysis comparing the BATSE SD spectra with burst spectra from COMPTEL, EGRET, and OSSE is near completion.

<u>Page #</u>	<u>Task Number</u>	
45	<u>93-09-00</u>	Barthelmy continued his work on the GTOTE project and the GRB follow-up proposals. His efforts have contributed to the explosion in scope from BACODINE's original idea, discovering the existence of many instruments that are capable of making meaningful follow-up observations. Dr. Barthelmy oversaw eleven collaborations at a total of fifteen sites around the world with a total of twenty three instruments receiving BACODINE burst positions.
47	<u>93-10-00</u>	Seifert led the Transient Gamma-Ray Spectrometer (TGRS) data analysis and Ground Support Equipment software development and is responsible for writing the software requirements/specifications and documentation. He is also designing and testing the algorithms which are being used by the software. Dr. Seifert worked on the development of the TGRS data analysis software and made preparations for TGRS/WIND flight operations.
48	<u>93-11-00</u>	Mitchell furthered the development work for the new ISOMAX balloon program and the analysis of the 1992 IMAX flight. Preparations for the WiZard 1994 balloon campaign were made and the analysis of data from accelerator experiments were conducted. In addition, Dr. Mitchell dealt with development efforts on new flight and ground based experiments. He had two new papers accepted for publication.
51	<u>93-12-00</u>	Dingus completed the design of the time projection chamber and further perfected the track fitting algorithm for drift chambers. In addition, she attempted xenon reclamation and purification and has in process two papers near completion. Dr. Dingus submitted a proposal for ROSAT, another for GRO Cycle 4 and served as CoI on eight other EGRET Team proposals.
53		Esposito continued his laboratory work on the Advanced Gamma-ray Astronomy Telescope Experiment (AGATE) and conducted analysis of EGRET data. In addition, he has completed his current programming support of the EGRET likelihood analysis software, along with his work on giant molecular clouds with combined phase I and II analysis of the Taurus cloud. Dr. Esposito has submitted a Compton GRO Phase IV proposal and has co-authored three papers during this quarter.

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- 55 **93-12-00** **Sreekumar** assisted the team to carry out the analysis and routine reduction of data from the EGRET instrument on the Compton Gamma Ray Observatory. In addition, his responsibilities this quarter included helping out with the overseeing the manual editing of spark chamber events on screens, creating the summary database and the exposure history database for each viewing period. He also spent considerable time examining the high energy gamma ray emission from the North Galactic Pole region using observations carried out by EGRET during Phase I and II.
(cont.)
- 56 **93-13-00** **Miller** worked on a project considering stochastic gyro-resonant ion acceleration by cascading Alfvén wave turbulence. Other projects he dealt with were the investigation of the nonlinear Landau damping of two parallel Alfvén waves by a hybrid plasma simulation and evaluating the problem of stochastic acceleration in black hole magnetospheres, along with the accompanying radiation processes. Various papers were initiated regarding these projects and a Compton GRO Guest Investigator proposal has been submitted.
- 57 **93-14-00** **Soong** carried out research which was a part of the center DDF proposal. The improvements of the image of the thin foil X-ray mirror with the newly established replication process has been verified. He also worked on the ASCA data analysis and the Galactic binary X-ray emitters. The proposal for further study of mirror development and research was approved and funded by NASA/HQ.
- 58 **93-15-00** **Yaqoob** analyzed data collected in the ASCA observations during the Verification phase. The writing up of the analysis results for the ASCA PV observation of the quasar PG1211+143 was initiated as analysis of the ASCA PV data on the Seyfert galaxy is in progress. He also wrote and submitted four proposals to observe targets in the AO-2 Guest Observer phase of ASCA. Another was submitted to observe two target with the ROSAT High Resolution Imager (HRI).

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- 60 93-16-00 **Madejski**** worked primarily on the X-ray Spectrometer (XRS) instrument. In addition, Dr. Madeski researched the: 1) analysis of the data for the multi-wavelength campaign for BL Lac object PKS2155-304, 2) analysis of the X-ray spectral data for BL Lac object AO 0235+164, 3) analysis of the BBXRT data for BL Lac object PKS2155-304, 4) multi-wavelength campaign to observe OVV blazar 3C279, and 5) study of reprocessing in Seyfert I galaxy. Proposals for ASCA and ROSAT have been accepted and a total of six others to ASCA, ROSAT and GRO have been submitted.
- 63 93-17-00 **Loewenstein**** continued to analyze ROSAT observations of low luminosity early type galaxies and worked on the ROSAT and ASCA data modeling and interpretations. He had a paper published, and two others he co-authored was accepted for publication. Two ASCA AO-2 proposals submitted, another Dr. Loewenstein wrote as Co-I and yet another he is Co-I for which is being submitted from the Japanese side.
- 64 93-19-00 **Hubeny**** continued his work on non-LTE model stellar atmospheres including the effect of millions of spectral lines and assisted in the discovery of the presence of nickel in the atmospheres of hot DA white dwarfs, which were initially thought to be completely free of any traces of metals. He also collaborated with other scientists to develop an universal spectrum synthesis program for binary stars and to research theoretical interpretation of the EUVE spectra of the brightest object seen in the EUV region. In this quarter, Dr. Hubeny has submitted five papers that await acceptance for publication.
- 66 93-20-00 **Barrett**** worked on the completion of the analysis program FADMAP and began work on testing this program. Transferring of the SAS-2 data from 9-track magnetic tape to 8mm DAT tape was conducted, and several small projects associated with the COS-B and SAS-2 data is near completion. Efforts continued to prepare for the next CGRO NRA (cycle 4), including supervision of the remote proposal submission (RPS) software. Dr. Barrett has submitted a total of nine proposals for ADP, ROSAT and ASCA NRA.
- 70 **Bonnell**** assisted in the preparation of materials for a GRO display at the National Air and Space Museum and prepared version 1.0 of the Compton GRO Science Support Center user's guide. He also performed time domain and spectroscopic analysis of gamma-ray bursts and support duties for the search for optical burst counterparts in accordance with on-going research projects.

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- 71 **93-20-00** **Finger** served as BATSE instrument specialist, overseeing the production of archival data products. He was also involved with research on the study of the long term behavior of x-ray binary pulsars using the BATSE hard x-ray data and conducted a timing analysis to determine its period history during the outburst. In regards to a giant outburst of the x-ray binary A0535+262, he conducted power spectral studies. In addition, a Compton GRO Guest Investigation proposal was submitted.
(cont.)
- 73 **Macomb** worked as co-investigator for four GRO proposals, one ROSAT proposal and as PI on one ASCA proposal. He also continued to work on an archival EGRET data analysis project to place upper limits on transient gamma-ray emission from several x-ray binaries and performed final testing on the EGRET Point Expose program before releasing it to the general public.
- 74 **Mattox** wrote ~126 email messages in support of EGRET Guest Investigator activities and made or received ~30 phone calls. He also wrote a paper on likelihood analysis of EGRET data and three Cycle 4 EGRET proposals. He was a Co-I on ~6 additional proposals.
- 75 **McGlynn** continued to develop the Sky View system for display of all-sky data and to direct the activities of K. Scollick in developing software for the Sky View user interface. In addition, he researched the gamma-ray emission from clusters of galaxies and gave technical direction to activities of the COSSC software staff. Dr. McGlynn also prepared EGRET data for distribution on the first GRO CD ROM and assisted in the development of the COSSC User's Guide document.
- 76 **Shrader** served as CGRO-SSC Group Leader. Extensive preparations were made for a presentation to NASA Headquarters, requesting an extension of the CGRO Mission. Preparations were also made this quarter for the Cycle 4 CGRO Guest Investigator proposals. Software for the electronic submission of proposal forms was modified and tested for use with CGRO. Guest Investigator inquiries, too numerous to list, were handled and two CGRO Guest Investigator proposals were submitted.
- 78 **Stacy** participated in the SSC team who received from the COMPTTEL team low-level and first high-level data products from Viewing Periods 23-28, for inclusion in the CGRO public archive. He also worked on creating a database of COMPTTEL GI information using the ORACLE database manager and continued drafting an introductory COMPTTEL data analysis and COMPASS user's guide. He is a co-investigator on an accepted NASA ADP proposal to analyze COBE data.

University Space Research Association
Goddard Visiting Scientist Program

Employee name: Lorella Angelini Task Number: 5030-01A-39

Period: 1 January 31 March 1994

Software Development and maintenance

A new release of XRONOS and XIMAGE has been completed during this period. The software now is available under DEC machine running ULTRIX and OSF, under SUN, VMS, and has been ported also under Alpha/VMS.

XIMAGE The XIMAGE 2.32 includes a number of new features. The detection algorithm retrieves the theoretical Point Spread Function for the following instruments: Einstein HRI, ROSAT HRI and PSPC, EXOSAT CMA, ASCA GIS and SIS, with an option to account for energy dependency as well as position. The command PSF, which allows to measure the observed point spread function, has been upgraded to account for the spectrum. Circle as well as boxes can be used to evaluate the counts. A vignetting command, using the theoretical vignetting function, modifies the current exposure map. Two or more images can be displayed at the same time, together with the overlay of intensity contour plot (useful to compare an contrast part of the sky observed from different missions/telescopes). To allow the overlay between images from different instruments, a command, which resizes the pixel size has been inserted. Hardness ratio and map corrected by the exposure can also be calculated and displayed. The number of bugs has been fixed.

XRONOS The main feature in XRONOS 4.0 is the fits reader, and writer. The fits reader has been build to handle a number of different layout for the data file, following the ogip memo OGIP/93-003 by Angelini, Pence , and Tennant. A fair amount of testing, on different data set, has been done to the ascii reader as well. A re-structure of the XRONOS programs will start in May. This mainly will change the way how parameters are passed to the programs. The XPI interface will be used. A full time programer is working with me on this project.

FITS activities

I worked on a number of documents :

1) 'Standard String for Telescope, Mission, and Filter', by I. George and L. Angelini. The document has been completed.

2) 'Standard String for DATAMODE and OBSMODE', by L. Angelini and I. George, At the moment it includes the keywords definition for ASCA, Einstein SSS, Ariel V, and a part of XTE. The memo will be updated all the time a new mission is archived.

3) 'OGIP standard format for Images', by L. Angelini, I. George and B. Pence. A good draft of the document has been done. This includes the description of the second frame in a fits image, the description of the layout of all the different type of images used in imaging analysis (exposure, vignetting, background, sky and detector map)

I reviewed the FITS file produced for the following mission COS-B, SAS-3, Einstein SSS raw data.

EXOSAT related activities:

EXOSAT archive raw data: The archiving in the optical juke-box of all the EXOSAT data has been completed (about 150 Gbyte of data). I probably expect to receive a couple of more tapes from ESRIN when the recovery of the 'damaged' tape is finished. All the data has been uniformly compress using 'zoo'. From the list containing basic information for each archive file, a browse database table has been created. This allows external user to search and retrieve the EXOSAT raw data from the on-line service. The documentation for the database has been written.

In the near future the portable analysis software, provided by ESA/ESTEC will be install on the legacy computer and the archive open to the scientific community.

FITS reformatting The reformatting of the EXOSAT products, light curve and images is underway. The reformatting has been completed for image (LE1 and LE2 experiment 3670 files), light curves for GS and ME experiments (which correspond to 70% of the 33038 files). The light curves for the LE should be completed by the end of April.

EXOSAT calibration I start the archive of the calibration information. The calibration spectrum for the GS and ME are now in HEASARC. The GS background spectra has been converted into old style spectral file format. The program to reformat the ME difference spectra is underway. Both sets of spectra will be converted for the archive in fits. The calculation of the efficiency for ME and GSPC and the UV contamination (of the X-ray count rate for the LE telescope) programs has been re-written.

Scientific Research:

Scientific projects: 1) *The analysis of my Rosat data of the X-ray pulsar X1626-67, and the PV data obtained with ASCA for the same source.* The main goals were to (a) investigate the pulse-profile with energy, (b) measure the period and the period derivative, (c) look for the Fe L-shell emission-line complex around ~ 0.75 keV. From the first analysis of the data shows clearly the changing of the pulse profile with energy, occurring at 1.4 keV, which was discovered by HEAO-1, and no further confirmed. ROSAT: The source was observed in two occasions: September 1992 and April 1993. In both cases the source was found spinning up. This surprising results is also confirmed by the BATSE instrument which monitor constantly a number of 'interesting' pulsar. The timing analysis however is clearly complicated by the artificial ROSAT wobble, which introduced spurious periodicity in the data. This made the search for the QPO detected with GINGA, rather difficult. In fact due to the particular set up of the observation the spurious periodicity occurs at the same frequency of the expected QPO. More careful analysis is required. This work is done in collaboration with Dr. P. Gosh which visited Goddard in October.

ASCA: The source was observed in May 1993. Timing analysis confirms the spinning up behavior seen with ROSAT and BATSE. The pulse profile shows that the pulse fraction is higher at energy above 3 keV. QPO were detected at energy above 2 keV. Pulse phase spectroscopy shows clearly that two components are required to fit the data: the low energy component, similar to the one observed with ROSAT which does not change with phase, and the high energy component which instead is phase dependent.

Those results were presented at the "New Horizon of X-Ray Astronomy: First Results

from ASCA" conference in Tokio March 8-11 1994.

3) *Timing analysis of EXOSAT data for the black hole candidate Cygnus X-1* were also presented at "New Horizon of X-Ray Astronomy: First Results from ASCA" conference in Tokio March 8-11 1994.

2) *The optical identification of the serendipitous sources in HH-1 (see Pravdo, Angelini Ap. J. 1993)* Most of the X-ray detections, derived from the Rosat observation in the star formation region in Orion close to HH-1, have no optical counterpart or poor information about spectral classification. We applied for optical time at the Palomar 60-inch telescope. The optical run, consisting in 3 night in december, were successfully done. From the data analysis we found that all the unknown star are emission line with a spectra similar to late pre-main sequence star. The accurate measurement of the width of the H_{α} line is in progress. This work is done in collaboration with Dr. S. Pravdo.

CODE 668/LHEA:HEASARC RESEARCH SCIENTIST

1994 January 1st - March 31st

WORK ACCOMPLISHED AND IN PROGRESS

I assisted K.P. Singh (a new NRC fellow in the HEASARC) in the preparation and submission of 2 ASCA AO-2 proposals for which I was a co-investigator. The proposal reviews were held at the end of March and the results should be promulgated to the proposers at the end of April. I was also a Co-I on several other proposals that were submitted for the ROSAT AO-5 program, including one PI'ed by Stephen White (University of Maryland) to observe several Luminous Blue Variable (LBV) stars (objects like the peculiar star eta Carinae) and one PI'ed by Jeffrey Linsky (University of Colorado) to do a rotational modulation study of the Magnetic Bp star HR 5624.

I continued to co-ordinate the debugging and enhancement of the HEASARC's database access system XOBSEVER/BROWSE on its Ultrix-based LEGACY computer. The system now appears to be stable, and thus at the end of February it became the HEASARC's prime archive. I tested the new hdbreq feature of BROWSE that enables users to send tables of co-ordinates by e-mail to LEGACY and have it do a cone search in a specified database and then e-mail the results back to the user automatically: the system worked very well. I also continued to monitor the anonymous ftp service and the ADS access provided by the HEASARC.

I attended the HEASARC Users' Group Meeting held on February 24 and gave a presentation on the status of our various on-line services. I also attended the AAS Meeting held in Crystal City, VA from January 12 through 15 and assisted at the HEASARC display.

I started working with Jesse Allen (Hughes/STX) on our project to make a FITS database out of the Einstein MPC database. We discussed with Keith Arnaud the most appropriate strategy to follow, and I made a draft of a FITS file format for Allen to construct. This activity seems fairly straightforward and should be accomplished within 3 or 4 month, I estimate.

I reviewed a large number of proposals submitted to a national observatory in my role as referee for observing proposals. This activity took about 1 week of my time. I also accepted a request from the NSF that I act as a reviewer for proposals submitted to one of their research programs, commencing this summer.

I, together with KP Singh (NRC), Nicholas White (GSFC), and Ted Simon (U. Hawaii) worked on a draft of a paper to be submitted to ApJ (Letts) containing the results of our preliminary analysis of 2 ASCA observations of solar-type stars that were done at the end of 1993 as part of ASCA AO1. KP Singh and I started the analysis on February 16 using the new XSELECT software package, and, thanks to Dr. Singh's diligence, it was completed in about 3 weeks. The paper will be submitted to ApJ (Letts) for their special ASCA results issue by the end of April.

The paper on the re-analysis of the existing Solid State Spectrometer (SSS) and Transmission Grating Spectrometer (TGS) spectra of the active binary star Capella, written by myself, Nicholas White (OGIP), and Jelle Kaastra and Rolf Mewe (SRON, Holland), was still being revised at the end of March, after a bug was discovered in the X-ray spectral analysis package that was used in this study. The revised paper should be submitted to the journals in the second quarter of 1994.

A list of my publications in 1994 to date is appended to this report.

NON-LOCAL TRAVEL

I went to the National Radio Astronomy Observatory in Charlottesville, VA from March 10th - 14th in order to reduce about 1 days' Very Large Array radio continuum observations of stars that I had accumulated in the last 12 months or so. I completely reduced all of the outstanding data: e.g., in 1993 I observed 138 stars as part of several different VLA programs, detecting 25 of them as radio sources.

WORK PLANNED FOR NEXT QUARTER

I will oversee the creation of a new independent and complete Einstein Monitor Proportional Counter (MPC) database to replace the version presently in the HEASARC database that contains only a small fraction of the available MPC data.

I will oversee the FITSification of the SSS database and the creation of software tools to analyze said data after the verification of the accuracy of the data stored in the FITS files is completed.

I will continue overseeing the anonymous ftp account on HEASARC's LEGACY computer, as well as the HEASARC's ADS node.

I will submit the Capella SSS and TGS paper discussed above to the Astrophysical Journal, and a paper on radio observations of Am and HgMn stars to the Astronomical Journal.

BIBLIOGRAPHY OF DR. STEPHEN A. DRAKE FOR THE YEAR 1994

LAST UPDATED: April 15, 1994

A. Research Papers

(i) Published or In Press in 1994.

1. Drake, S.A., Linsky, J.L., Schmitt, J.H.M.M., and Rosso, C., "X-Ray Emission from Chemically Peculiar Stars", *Ap. J.*, 420, 387. (1994).
2. Drake, S.A., Simon, T., Linsky, J.L., and White, N.E., "An Efficient Way of Identifying New Active Stars: A VLA Survey of X-Ray-Selected Active Stellar Candidates", in *Proceedings of the 8th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun*, ed. J.-P. Caillault, (ASP, San Francisco), in press. (1994).
3. Drake, S.A., White, N.E., Smale, A.E., Marshall, F., Angelini, L., and Pravdo, S., "An X-Ray Spectral Study of Algol Binary Systems", in *Proceedings of the 1st Annual ROSAT Science Symposium and Data Analysis Workshop*, ed. E. Schlegel, in press. (1994).
4. White, S., Duncan, R., Drake, S.A., Lim, J., and Kundu, M.R., "Eta Carinae", *IAU Circular No. 5932*. (1994).
5. Drake, S.A., Richmond, A., O'Neel, B., and Barrett, P., "Access to the HEASARC on Legacy via Anonymous ftp, Gopher, WWW, and ADS", *Legacy*, No. 4, p. 16. (1994).
6. Drake, S.A., Yom, S., and Pollock, A., "Access to the HEASARC on Legacy via BROWSE", *Legacy*, No. 4, p. 20. (1994).

(ii) Submitted but not yet Accepted.

None.

B. Published Abstracts

None.

UNIVERSITIES SPACE RESEARCH ASSOCIATION
GODDARD VISITING SCIENTIST PROGRAM

QUARTERLY TECHNICAL REPORT
1994 Jan 01 – 1994 Mar 31

Employee Name: Ian M George

Activity: 5030-01A-39

Programatic Activities

Caldb Infrastructure & Access

My programatic responsibilities continue to be dominated by the maintenance & development of the *OGIP Calibration Database*, an on-line database designed to contain calibration files for all instruments for which the OGIP is responsible for supplying scientific data. Calibration datasets & documentation continue to be delivered by the various instrument teams and Guest Observer Facilities (GOFs) of current mission, as well as by HEASARC personnel responsible for the restoration/conversion of data from old mission.

The entire database continues to be accessible on-line via the `legacy.gsfc.nasa.gov` computer, and available world-wide via anonymous ftp, WWW *etc.* The number of files taken from the database per month continues to be somewhat erratic, but continues to show an upward trend (Figure 1). A total of 2807 files were copied by (non-LHEA) ftp users in this quarter demonstrating its value to the general community. A smaller number of files were also copied via other means (*eg* gopher, WWW *etc.*). The large spike of *ASCA* data files copied in Jan/Feb is most likely the result of the official opening of *ASCA* calibration database on 1993 Dec 20.

FTOOLS *s/w*

For the most recent public distribution of `ftools` (v2.9; release date 1994 Apr 21) it was decided to sub-divide the numerous tasks amongst a larger number of sub-packages. As a result, a number of former `caltools` have been reassigned to other packages. Specifically, the `caltools` sub-package now contains only multi-instrument tasks, whilst instrument-specific tasks have been moved to appropriately named sub-packages (*eg* `rosat`, `asca`).

Work has continued to develop calibration software tasks under the `ftools`. A major effort was undertaken last quarter to introduce OGIP-developed Dynamic Memory Allocation routines so as to greatly reduce the memory requirements of the `ftools` package within the IRAF environment. This has been completed for all the tasks for which I am responsible. I have contributed the following new tasks to the forthcoming `ftools` release:

- `ftools/caltools/calcrpsf` - A multi-task wrapper for a series of tools concerned with the generation & manipulation of radial point spread function datasets.
- `ftools/heasarc/mathpha` - Performs mathematical operation on PHA datasets

and supervised OGIP programmers in the writing of several more.

FITS File Formats

I have continued to serve as the secretary of the OGIP FITS Working Group (OFWG). The OFWG is comprised of at least one member from each group within the OGIP, and was set up to ensure that new FITS file/keyword definitions firstly do not violate any pre-existing FITS standards/conventions, and secondly wherever possible to ensure all the immediate (and medium term) needs of the OGIP can be fulfilled. Meetings are held approximately every two weeks, and besides the writing of the minutes, my main responsibility is to maintain the OFWG's documentation area under the `legacy.gsfc.nasa.gov` anonymous ftp area. The same files are also available via the WWW.

Other

During the period 1994 Mar 23–25 I took part in the *ASCA* AO-2 Peer Review as a scientific reviewer.

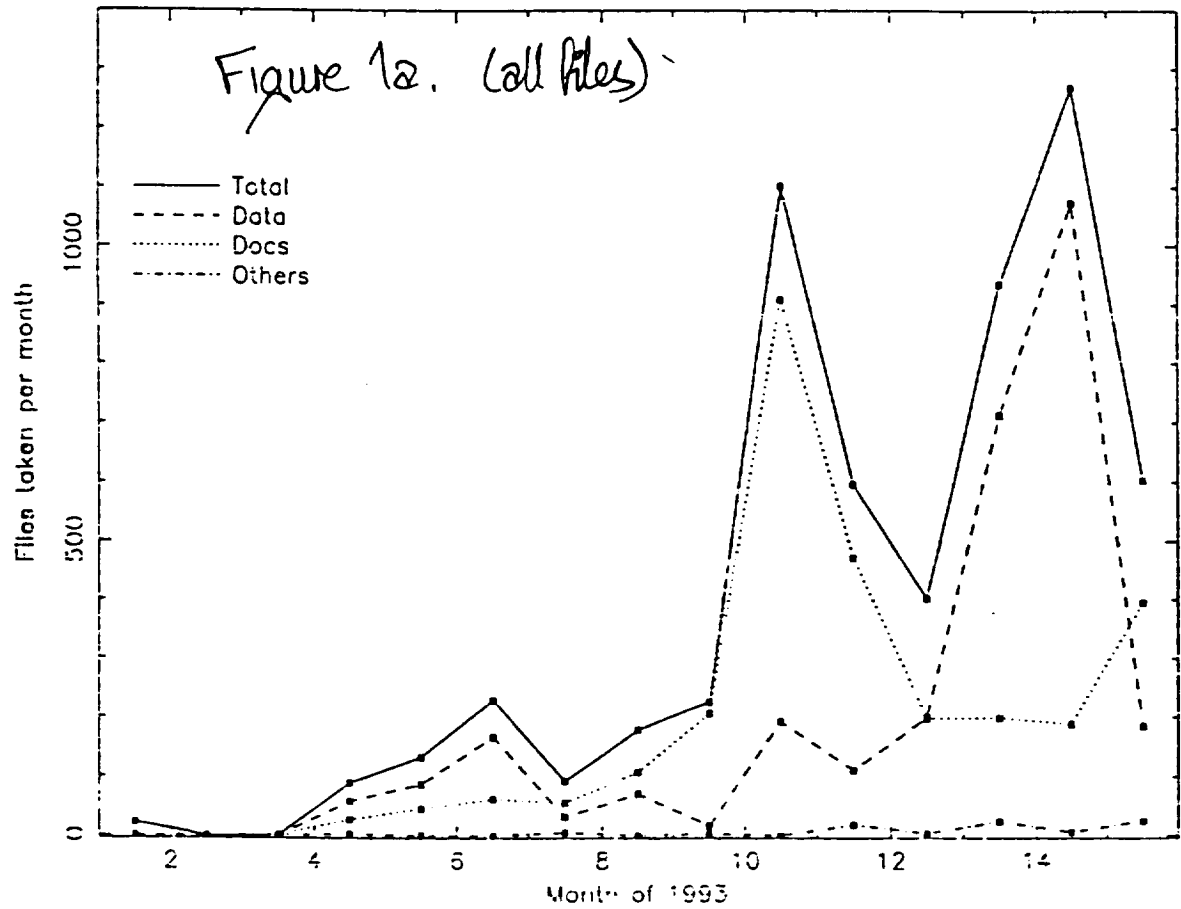
Personal Research Activities

As usual, due to the demands of my programmatic work, I was able to dedicate little time to research this quarter.

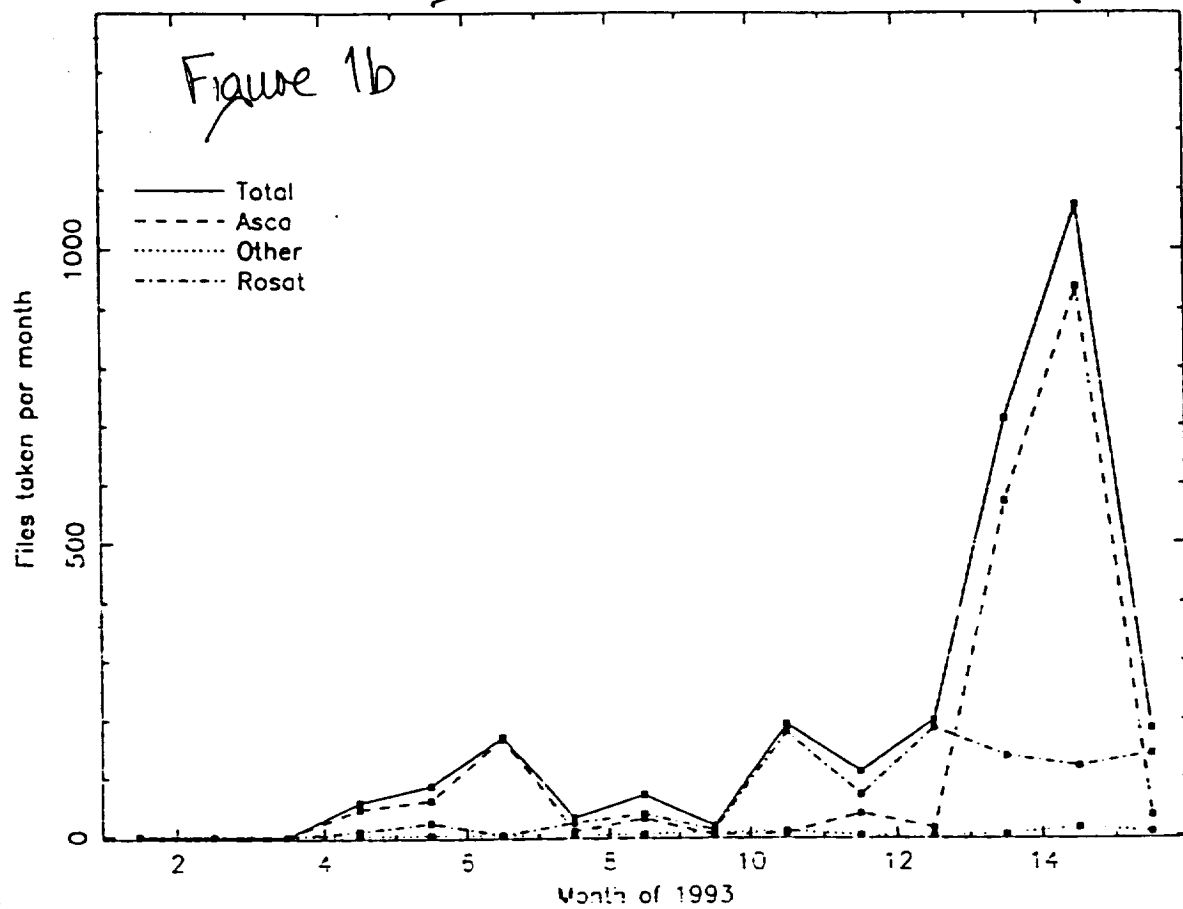
In collaboration with Nandra (IoA, Cambridge, UK), Turner (USRA) and three other collaborators world-wide, a paper arising from *ROSAT* PSPC AO-1 observations of the Seyfert 1 galaxy Mrk 841 is soon to be submitted. We find the source to be variable on short timescales with clear changes in PSPC 'hardness ratio' (the ratio of fluxes in the high & low energy bands of the *ROSAT* PSPC) indicating the presence of at least two spectral components. We find that the *ROSAT* spectrum is best fit by models in which the intrinsic powerlaw spectrum is modified either by absorption by highly ionized material along the line-of-sight, or by an additional emission component contributing to the lowest energy PSPC channels. Remarkably, simultaneous spectral analysis of this PSPC dataset and the ultraviolet (UV) continuum data (obtained pseudo-simultaneously with the *International Ultraviolet Explorer*, *IUE*), show that the best-fitting PSPC powerlaw extrapolates well into the UV. For this reason, the canonical accretion disc models of the UV/soft X-ray emission provide a poor explanation of the data. The paper then goes on to briefly explore the possible physical explanations of these data. Work is currently underway to analyse a *ROSAT* PSPC AO-3 monitoring campaign on this source, along with a large set of *IUE* and optical archival data.

In collaboration with Alloin (Observatoire de Paris) and a cast of thousands, I contributed to a paper reporting the results of a large multi-waveband observing campaign of the Seyfert-1 galaxy NGC 3783. These observations, of which I contributed the *ROSAT* data, were carried out under the framework of the 1992 *World Astronomy Days* (an ESA-sponsored activity that was established to coordinate on a worldwide basis the use of many facilities on a chosen target). The paper discusses at length the decomposition of the observed spectral energy distribution into the 'pure' underlying AGN emission from components due to gas, dust & stars within the host galaxy. Explanations for the physical nature of the underlying continuum in this and other Seyfert galaxies are then explored. The paper has been submitted for publication.

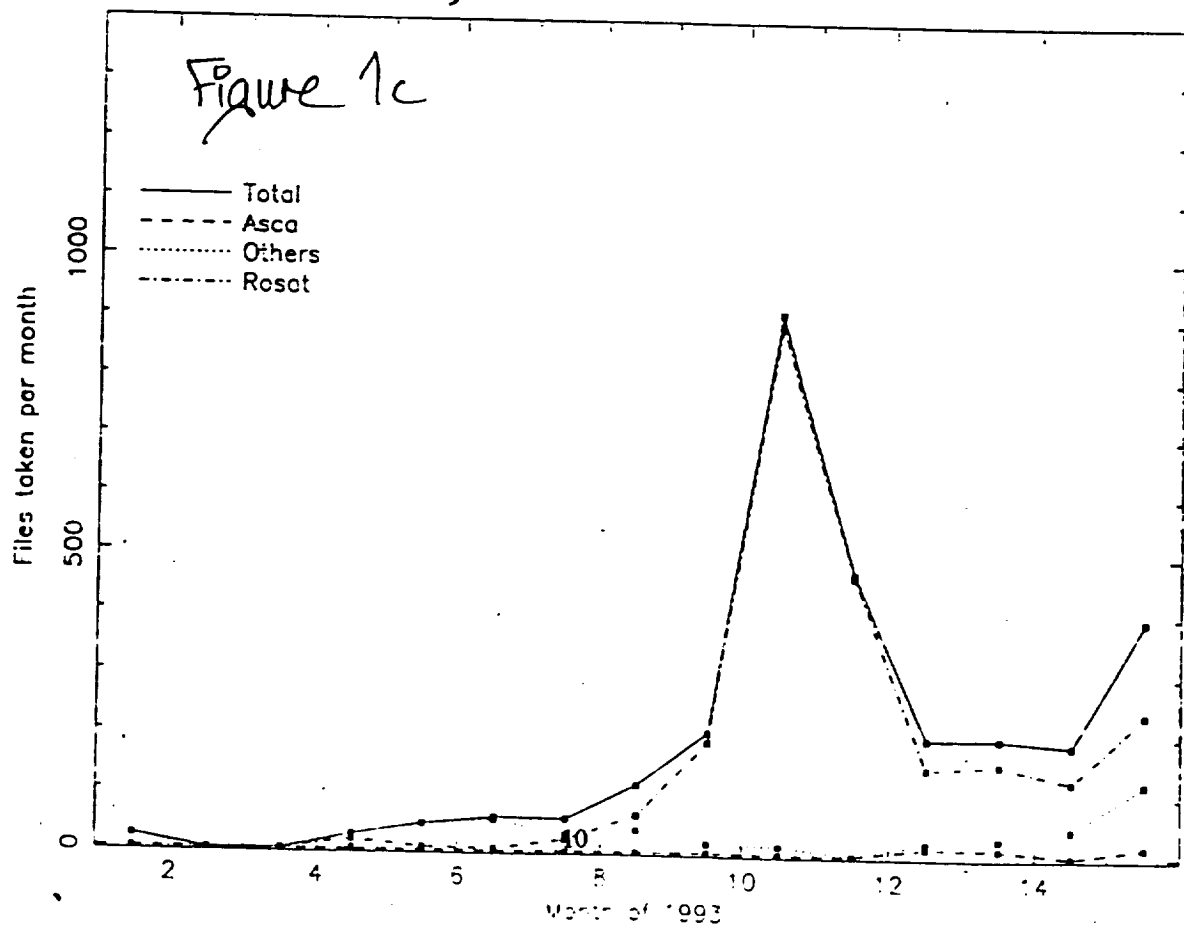
CALDB FILES TAKEN (via anon ftp, excluding LHEA users)



GEORGE 4-APR-



GEOPAGE 4-12



During the period 1994 March 17–21 I performed an intensive *IUE* monitoring campaign of the BL Lac 0716+714 (80hrs of observing in 96 hrs !). This went generally well, though the source was unfortunately in a rather low state. Data reduction and interpretation in collaboration with Edelson (Iowa) is awaiting arrival of the data tapes. ASCA review

Papers Published/Accepted (in quarter ending 1993 Dec 31)

Refereed Journals:

1. **X-ray reprocessing by cold clouds in Active Galactic Nuclei**
Nandra, K & George, I.M.
1994. *Mon. Not. R. astr. Soc.*, in press.
2. **The UK Deep and Medium Surveys with ROSAT: Log N – Log S**
Branduardi-Raymont, G., Mason, K.O., Warwick, R.S., Carrera, F.J., Mittaz, P.D., Puchnarewicz, E.M., Smith, P.J., Barber, C.R., Pounds, K.A., Stewart, G.C., McHardy, I.M., Jones, L.R., Merrifield, M.R., Fabian, A.C., McMahon, R. Ward, M.J., George, I.M., Jones, M.H., Lawrence, A. & Rowan-Robinson, M.
1994. *Mon. Not. R. astr. Soc.*, in press.
3. **Multi-wavelength Monitoring of the BL Lac Object PKS2155-304.**
IV. Multi-Wavelength Analysis
Edelson, R., Krolik, J., Madejski, G. Maraschi, L., Pike, G., Urry, C.M., Brinkmann, W., Courvoisier, T.J.L., Ellithorpe, J., Horne, K., Aller, H.D., Aller, M.F., Ashley, M., Begelman, M., Blecha, A., Bouchet, P., Bratschi, P., Bregman, J.N., Carini, M., Celotti, A., Donahue, M., Fiegelson, E., Filippenko, A.V., Fink, H., George, I.M., Glass, I., Heidt, J., Hewitt, J., Hughes, P., Kollgaard, R., Kondo, Y., Koratkar, A., Leighly, K., Marscher, A., Matheson, T., Martin, P.G., Miller, H.R., Noble, J.C., O'Brian, P., Pian, E., Reichert, G., Saken, J.M., Shull, J.M., Sitko, M., Smith, P., Sun W.-H., Tagliaferri, G., Treves, A., Wagner, S., Wamsteker, W. & Warwick, R.S.
1993. *Astrophys. J.*, in press.

Non-Refereed Journals, Conference Proceedings etc:

None

Other Articles:

1. **ROSAT PSPC Off-Axis Point Spread Function**
Hasinger, G, Boese, G., Predehl, P, Turner, T.J, Yusaf, R., George, I.M. & Rohrbach, G.
1994. *Legacy*, 4, 40.
(CAL/ROS/_93_015)
2. **Specification of Physical Units within OGIP FITS files**
George, I.M. & Angelini, L.
1994. *Legacy*, 4, 57.
(OGIP/93-001)

3. GRPPHA User's Guide

Yusaf, R. & George, I.M.

1994. *Legacy*, 4, 64.

(CAL/SW/93-010)

4. The Role & Initial Recommendations of the OGIP FITS Working Group

George, I.M.

1994. *Legacy*, 4, 72.

(OFWG_93_001)

Papers Submitted, not yet accepted by Refereed Journals:

1. X-ray Color Analysis of the Spectra of Active Galactic Nuclei

Netzer, H., Turner, T.J. & George, I.M.

1994. *Astrophys. J.*, submitted.

2. A snapshot of the continuous emission of the active galactic nucleus in NGC3783 from gamma-ray to radio wavelengths

Alloin, D., Santos-Lleo, M., Peterson, B.M., Wamsteker, W., Aitieri, B., Brinkmann, W., Clavel, J., Crenshaw, D.M., Evans, I.N., George, I.M., Glass, I.S., Johnson, W.N., Kriss, G.A., Malkan, M.A., Netzer, H., Polidan, R.S., Riechert, G.A., Rodriguez-Pascual, P.M., Romanishin, W., Starr, C.H., Stripe, G.M., Taylor, M., Turner, T.J., Vega, H., Winge, C. & Wood, D.O.S.

1994. *Astron. Astrophys.*, submitted.

Non-Local Travel

None

Work Planned for the period 1994 Jan 01 – 1994 Mar 31

Projected activities for the next quarter include:

- continued development of OGIP calibration infrastructure & access software.
- continued review & development of FITS file formats via the OFWG
- scientific analysis of recently obtained *ROSAT*, *ASCA* and *IUE* datasets

Progress Report 1 January - 31 March 1994

Task # 5030 - 01A-39

Laura A. Whitlock, Ph. D.



Programmatic

Got the complete Vela 5B and Ariel 5 data base products created and put into the HEASARC on-line services.

Provided user support for the on-line Vela 5B, Ariel 5, and HEAO 1 data bases. Worked to resolve problems with the HEAO 1 files brought into the HEASARC as a result of an ADP grant to Dr. John Nousek (Penn State U.) which were determined to be corrupted. These files will have to be remade by Penn State, and then brought back into the archive at some future time.

Completed making the 8mm duplicates of the data sets salvaged from the basement last year. The 8 mm versions of the HEAO 1 A-2 PHA, MAX, and XRATES data bases I created are still being used by Mike Stark (U. Maryland) and Dr. Jean Swank (NASA/GSFC) in their research.

Provided support to Dr. Ron Remillard of MIT to reformat the HEAO A-3 data. He is changing the data formats from the old Data General to UNIX. In doing so, he has found many old 800 bpi tapes which he cannot read on his machine. He sends these to me, I recover the data from them and mail him back something he can read and convert. This effort is roughly half done and should be finished in the second quarter of 1994.

Gave a presentation concerning the flood of data expected to arrive at the HEASARC over the next 18 months which has been created outside the HEASARC and its influence on file formats, etc. to the HEASARC Users Group meeting on 24 February. Recommendation that NASA-sponsored grants to create data bases for archive at the HEASARC be *required* to comply with HEASARC standards was endorsed by the committee and sent to NASA HQ for consideration.

Science

Issued a subcontract to Dr. P.S. Haskins of Radiation Technologies, Inc. to provide support for work on the ADP grant Eric Gotthelf and I won last year to examine the entire Vela 5B data base in search of transients. Work on this effort began in earnest with Dr. Haskins' arrival on 14 March. We have modified all of the software to systematically run through the data looking for statistically significant variations in the X-ray emission for any given region of the entire celestial sphere. A run through the complete 4 Gigabyte data base began in late March. Analysis of the results, refinement of the tests, etc. will continue into the second quarter of 1994. Preliminary results are promising.

Submitted Proposals

To the ASCA AO2 NRA from NASA Headquarters:

- "Circinus X-1: Still Crazy After All These Years?"
PI: L.A. Whitlock
Cols: N.E. White (NASA), J.C. Lochner (USRA), E.V. Gotthelf (USRA)
- "A Study of the Iron Line Emission of Scutum X-1"
PI: J.C. Lochner (USRA)
Cols: L.A. Whitlock, L. Cominsky (Sonoma St. U.), N.E. White (NASA),
E.V. Gotthelf (USRA), and R. Kelley (NASA)
- "Is 4U1907+09 a Non-Aligned Supergiant Binary"
PI: Lynn Cominsky (Sonoma State University)
Cols: L.A. Whitlock, E.V. Gotthelf (ISRA), J.C. Lochner (USRA),
N.E. White (NASA)
- "X-Ray Spectroscopy of the Be/X-Ray Binary GX304-1"
PI: Richard L. Kelley (NASA)
Cols: S.S. Holt (NASA), J.C. Lochner (USRA), Caroline Stahle (NRC),
L.A. Whitlock (USRA), Fumiaki Nagase (ISAS), L. Cominsky (SSU)

Papers

Submitted to *Astrophysical Journal*

- "Observations of the Small Magellanic Cloud by the Vela 5B X-Ray Monitor" by L. A. Whitlock and J. C. Lochner was submitted on 14 January. Conditional acceptance based on referee review received on 9 March. Corrections and responses to referee's comments will be submitted in April.

Printed in *Legacy*

- "All-Sky Monitor Databases Update" by L. A. Whitlock and P. L. Tyler (STX).
- "Once Upon a Time in the Basement" by L.A. Whitlock.

**1994 1st Quarter Report
M. F. Corcoran (660-038)**

To: Crystal Wheatley
From: Dr. M. F. Corcoran
Task No: 660-038
Subj: 1st Quarter Technical report, 1 January 1994 - 31 March 1994
Date: 15 Apr 1994

ACTIVITIES ACCOMPLISHED

1) ROSAT public archive

- a) Supervision of data ingest into the NDADS archive is continuing
- b) Public ROSAT data sets have been moved to the HEASARC jukebox attached to the legacy machine. In the 1st quarter this included all data released up through November 1993.
- c) The 1st volume of the ROSAT image CDROMs were distributed at the AAS meeting in Washington DC in Jan.
- d) Number of e-mail communications during the 1st quarter: 142

2) Rationalized FITS development for ROSAT

- a) supervision of the development of the RDF software continued through the 1st quarter. The version which will be used to re/process all ROSAT data was completed in the 1st quarter by S. Sweetland.
- b) Number of e-mail communications during the 1st quarter concerning rationalized FITS development: 319
- c) I completed the Appendix to the ROSAT Data Product Guides concerning the RDF formatted files.

3) OGIP FITS working group

- a) The OFWG has continued roughly bi-weekly meetings to discuss FITS issues in the OGIP.
- b) number of e-mail communications regarding FITS issues: 152

4) RGOF duties

- a) I provided guest observer support to 3 visitors to the ROSAT Guest Observer Facility in the 1st quarter: K.P. Singh, A. Hurford, and C. Day
- b) number of e-mail communications regarding RGOF issues: 35
- c) The RGOF continued it's series of bi-weekly meetings
- d) I revised/updated documents in the ROSAT anonymous FTP account regarding the ROSAT data archive

TRAVEL

- 1) Attended the AAS meeting in January 1994 in Washington DC to distribute the ROSAT CDROMs vol 1 and to provide support/demos at the HEASARC booth.
- 2) Attended the ASCA AO2 review in March 1994 at Tyson's Corners, VA

PAPERS ACCEPTED

**1994 1st Quarter Report
M. F. Corcoran (660-038)**

1) "The Carina Nebula in X-rays", M. F. Corcoran, J. Swank, G. Rawley , R. Petre, J. Schmitt , C. Day, in "Proceedings of the 1st ROSAT Workshop", in press.

2) "The Carina Nebula in X-rays", M. F. Corcoran, J. Swank, G. Rawley , R. Petre, J. Schmitt , C. Day, in Rev. Mex., in press.

TALKS

1) University of Pennsylvania, on the ROSAT observations of the Carina Nebula

PROPOSALS SUBMITTED/AWARDED

1) 4 proposals (3 with Corcoran PI, 1 as Co-I) were submitted for ASCA AO2 Results have not been officially distributed.

PLANNED 2nd QUARTER ACTIVITIES

1) Continue supervision of ROSAT Public Archive including ingest of WG data.

2) Finish development of rationalized FITS calibration data files.

3) Continue guest observer support activities

4) Publish results of analysis of ROSAT observations of Carina Nebula, V444 Cyg and BBXRT data of Zeta Ori.

5) Write draft of paper summarizing work with Catelli on Sco OB1

6) Begin analysis of Cyg OB2 ROSAT PSPC observation.

7) Produce vol 2 of the ROSAT CD ROMs for distribution at the Jun 1994 AAS meeting.

Dr. Steven L. Snowden
Quarterly Technical Report
1 January – 31 March 1993

21 April 1994

Code 666, Laboratory for High Energy Astrophysics
ROSAT Guest Observer Facility

Programmatic Work

Much of my programmatic work for this quarter has been in preparing for public release software for the analysis of *ROSAT* PSPC observations of extended sources and the diffuse X-ray background. While I had previously written much of the required software, it was Vax/VMS operating system specific with little documentation (the software was written for my own personal use). The software allows a Guest Observer to identify and exclude times of enhanced non-cosmic background contamination, model and subtract the residual contamination of the particle background, scattered solar X-rays, and long-term enhancements, and properly correct for exposure, vignetting, and detector artifacts. This provides the best possible estimate of the absolute surface brightness for an individual observation and is being used for many scientific papers.

Presently I have converted a package of thirteen programs to operation on the more widely used unix operating system machines. This code is now rather successfully undergoing beta-site testing at Johns Hopkins, New Mexico State University, Harvard-Smithsonian Center for Astrophysics, and the University of Michigan. In conjunction with the analysis software, I have written a cookbook and produced an illustrative example for its implementation and use. My lead-author paper "Analysis Procedures for *ROSAT* XRT/PSPC Observations of Extended Objects and the Diffuse Background" that I mentioned in the previous quarterly report has now appeared in print in *The Astrophysical Journal*.

Scientific Work

The most tangible progress this quarter was the acceptance of my lead-author paper "Soft X-ray and H I Surveys of the Low N_{H} Region in Ursa Major" for publication in *The Astrophysical Journal* (to appear in August). I was also invited to give a colloquium at the Johns Hopkins Center for Astrophysical Sciences in February at which I gave the talk "*ROSAT* observations of the Soft X-ray Background Radiation." Along with preparing the software mentioned above, I have tested it on a large mosaic of pointings of the LMC, SMC, and the Ophiuchus Dark Clouds. The results are spectacular and show a great deal of structure never before visible, and will take years to analyze.

I submitted a *ROSAT* AO-5 proposal for a mosaic of HRI pointings of the SMC and participated on a similar proposal for the LMC. Coupled with the complimentary PSPC maps mentioned above, these data will provide by far the best the tools for studying our neighbor galaxies in the X-ray energy range.

Plans for the Next Quarter

At present, there are a large number of projects going which I am directing for the *ROSAT* Guest Observer Facility. We have finally received ground recalibration data for the PSPC. While the current spectral calibration of the PSPC is in general relatively good, there are residual systematic errors which significantly reduce the utility of high statistical-precision data. A first pass through these data indicate that while they are quite clean, however, there has been a degradation of the detector which will complicate the analysis. We have also finally received the long-awaited working draft of the "*ROSAT* Users' Guide" from the Max Planck Institute for Extraterrestrial Physics. I will be the single-point GSFC interface for communication with MPE for revising, improving, and extending the RUH. With the reprocessing of *ROSAT* data soon to start, the software to produce trend data files (files containing housekeeping and orbit geometry data useful for monitoring instrument status on a daily basis) must be completed. Finally, I will provide technical support for the AO-5 *ROSAT* peer review and will likely travel to Munich for the International Users Committee proposal review. At the time of the IUC review, I hope to finish up the US GOF contribution to the RUH.

In my scientific work, I will continue on several papers in progress. Most notably my response to the referee's comments on a paper about M101, a paper on the *ROSAT* all-sky survey, and a paper on the LMC and SMC mosaic of pointings. I will have a summer graduate student working for me who will start in June. Also during the next quarter I will give a Laboratory for High Energy Astrophysics seminar (3 May) and present a poster at the summer meeting of the AAS in Minneapolis.

Quarterly Report for Jan 1 1994-March 31 1994

T. Jane Turner

Project Support:

1) I have worked with Mary Odell to fill out some ROSAT information pages for the World Wide Web. The ROSAT Mission and ROSAT GOF pages URLs are

<http://heasarc.gsfc.nasa.gov/0/docs/rosat/rosat3.html>
and
<http://heasarc.gsfc.nasa.gov/0/docs/rosat/rosgof.html>
respectively.

2) I have significantly updated all the ROSAT "Frequently asked Questions" files which are available on our ftp account. These files contain a lot of instrument and data analysis information in the form of question/answer pairs.

3) I have worked with members of the ASCA team to do some spectral and flux cross calibration of the ROSAT PSPC and the ASCA SIS and GIS instruments using in-flight calibration data. Suitable calibration sources include constant sources (over the mission lifetime) such as supernova remnants and white dwarfs.

I have also worked with Dr Corcoran and Jim Ingham to ensure that the forthcoming ROSAT RDF format (Rationalized FITS) files will be readable in the ASCA analysis system XSELECT (with ftools).

AGN Science:

1) ASCA observations of NGC3783: (PI Dr. Ian George)

Observations over the last few years have shown that AGN contain a large amount of absorbing and reprocessing material in the vicinity of the active nucleus, this modifies the AGN continuum radiation substantially. Thus to understand the physics producing the X-ray continuum radiation we first need to deconvolve the nuclear continuum and the signatures of this reprocessing. The shape and variability of the observed spectrum depends on the detailed ionization state, orientation, geometry and abundances of this circumnuclear material and ASCA observations will be the first to have the energy resolution, sensitivity and necessary exposure times to allow the first interesting constraints to be placed on these parameters. NGC3783 shows the strongest signature of warm absorption ever observed in a Seyfert 1 galaxy. Analysis of a high signal-to-noise ROSAT observation showed strong evidence for a soft X-ray absorption edge associated with oxygen vii-viii. Analysis of the SIS data immediately confirmed the deep absorption edge seen in the ROSAT data. Further analysis is in progress, and we await the second epoch ASCA observation to examine the change of ionization state of the absorbing material with hard X-ray flux.

2) Mkn841 multiwaveband monitoring campaign:

We have obtained numerous ROSAT PSPC observations of Mkn841, with simultaneous IUE and optical observations, over the mission lifetime. We are currently analysing those data, and attempting to interpret them in the light of current popular models for active galaxies, with discussion of the applicability of accretion disk models to the data.

Work anticipated for the next quarter

1) Analysis of ASCA observations of NRAO140: (PI: Turner)

NRAO140, a flat radio spectrum quasar at a redshift of $z = 1.258$, is one of the most luminous known X-ray quasars $L_{\{2-10 \text{ keV}\}} \sim 10^{47}$ ergs/s. This object has shown variable intrinsic X-ray absorption, and thus ASCA observations of it should be very interesting, since they will provide a probe of extreme conditions in the vicinity of an AGN. A high quality spectrum of this source will hopefully give us insight into the AGN emission mechanism process, and may answer some of the most fundamental questions in the field.

The extremely high luminosity may be related to a large central black hole mass, or may be due to beaming of the X-ray radiation. NRAO140 is a bright, core dominated radio source exhibiting superluminal motion with an apparent separation velocity of the radio components moving away from the core of $4.8h^{-1} c$, and thus its radio emission is quite likely to be beamed. Similarly, the synchrotron self-Compton limit requires some degree of anisotropy. Even though there is no direct evidence that the X-ray emission in this source is beamed, the correlation between the factor of 2 increase in both radio and X-ray fluxes strengthens the beaming hypothesis for the X-ray radiation. The data are due to arrive the first week in April 1994.

2) Work will also continue on the ASCA analysis of NGC3783, and the monitoring campaign of Mkn841.

3) GSFC have just received a copy of the PANTER ground recalibration data for the ROSAT PSPC. I will be working with Dr. Steve Snowden on analyzing these data, this is part of the effort to provide a better energy calibration for the PSPC. Uncalibrated time dependances and operation at uncalibrated gain levels have caused serious energy calibration problems.

4) June 6-8th the ROSAT AOS proposal review will be held. This round the community will be proposing for HRI time only, as the PSPC gas supply is exhausted and no further PSPC Guest Observer observations are possible.

5) I anticipate helping MPE finish the ROSAT Users Handbook. This compilation of ROSAT instrument, calibration, analysis and other information will be available online via anonymous ftp, the World Wide Web and in hardcopy form.

Programmatic Work

- o Staffed the ASCA booth at the January AAS meeting in Arlington, VA,
- o Assessed the technical feasibilities of ASCA AO-2 proposals preparatory to the AO-2 review in April.
- o Finished writing the "ASCA Getting Started Guide," a 34-page document describing ASCA data, data formats and data processing.
- o Assumed the responsibility for overseeing the insertion of documents into the ASCA home page on the World Wide Web.
- o Continued to field emailed queries sent by the US astronomical community to the ascahelp email "hot seat."
- o Continued to write, edit and compile the new issue of the "ABC Guide to ASCA Data Reduction," a (currently) 105-page document describing how to reduce ASCA data which will be completed in May.
- o Continued to coordinate (and to participate in) the advising of US ASCA PIs on how their AO-1 observations should be carried out.
- o Continued to coordinate (and participate in) the help given ASCA Guest Observers who visit the ASCA Guest Observer Facility at GSFC. In particular, I assisted Drs K.P. Singh (GSFC), J.D. Kurfess (NRL), P. Blanco (UCSD), Y-K Ko (GSFC).

Scientific Work

- o Co-authored a paper submitted by Nick White on an ASCA observation of AR Lac.
- o Invited to collaborate (and to give a talk) by Dr Christopher Mauche at Lawrence Livermore National Lab.
- o Submitted 2 ASCA AO-2 proposals as PI, 4 as Co-I.

Other

- o Completed the editing (with Dr Steven Holt) of the proceedings of the conference on X-ray binaries held at UMD last October.

□

TECHNICAL REPORT FOR JAN. 1 TO MAR. 31, 1994

Ken Ebisawa (USRA Research Scientist)
task # 666-024

code 668, ASCA Guest Observer Facility

Office of Guest Investigator Program

Laboratory for High Energy Astrophysics, NASA/GSFC

PROJECT WORK

- Worked at ISAS, Sagamihara, Kanagawa, Japan, from Feb. 23 to March 25 (travel report submitted). There I developed and tested ASCA data analysis system, communicating with other ASCA GOF members and programmers at GSFC.
- Participated in the ASCA software/science meeting on Mar. 7 at ISAS, Japan.
- Made ASCA GIS response data files for ASCA Guest Observers' use.
- Made ASCA GIS bank sky background database for ASCA Guest Observers to carry out GIS background subtraction.
- Helped to make observation plans for six US ASCA Guest Observers' observations.

RESEARCH

- Participated in the 183rd American Astronomical Society meeting at Washington, D.C. from Jan. 11 to 15, and presented a poster presentation with the title "Spectral Study of GX339-4 in the Low Intensity State Observed with GINGA".
- Participated in the "Horizon of the X-ray Astronomy" meeting at Tokyo Metropolitan Univ. from Mar. 8 to 11.
- *Papers Published:*
 - Ueda, Y., Ebisawa, K. and Done, C., "Spectral Study of GX339-4 in the Low Intensity State Observed with GINGA" Publication of the Astronomical Society of Japan, 1994, 46, 107
- *Papers Accepted:*
 - Ebisawa, K. et al., "Spectral Evolution of a Bright X-ray Nova GS1124-68 Observed with GINGA", accepted to Publication of the Astronomical Society of Japan, Mar. 1994.
- *Proposals Submitted:*
 - Ebisawa, K. et al. "Study of Pulsed X-ray Emission and Glitches of the Crab Pulsar" for ROSAT AO-5
 - Ebisawa, K. et al. "Verification of the Gamma-ray Pulsar Hypothesis of 2CG333+01 / 1E161348-5055.1 in the SNR RCW103" for GRO Cycle 4

Technical Report January 1–March 31 1994
Koji Mukai (Task number: 93-03-00)

ASCA matters: The winter meeting of the AAS was held at Crystal City, Jan 13–16 1995. I participated in the booth activity to publicize ASCA in general and the upcoming proposal deadline in particular; and to answer any questions about ASCA and related software.

AO-2 proposal deadline was Jan 31st and the proposal review was held Mar 23–25 at the Ritz Carlton in Tyson's corner. Related support activities took much of my time during the last quarter. All through January, astronomers trying to write ASCA proposals asked questions about ASCA capabilities, previous observations, and on proposal submission and support software. (This task was shared by all GOF scientists.) This spilled on to February, as the ESA deadline for ASCA was Feb 15 and they had no mechanisms or capabilities for answering such questions at ESA. Then, from late February to mid March, I read ~60 proposals to judge their technical feasibility. The review itself was ~3 days of intensive effort but my part in it was relatively minor.

AO-1 observation planning: I was the GOF duty scientist on two separate occasions, helping the GOs plan the details of their ASCA observations. For point sources, this is usually trivial (confirmation of the target coordinates is the major task); for extended sources, there were some details to be sorted out — target placement within the ASCA FOV, hot/flickering pixels and telemetry saturation issues etc.

I had 1 trip to Japan during last quarter, to attend the “New Horizon of X-ray Astronomy” conference and ASCA Science Working Group and software meetings. Roughly a year after launch, the operation of ASCA and the suite of software tools are both becoming more stable; the major issues discussed were the analysis of PV phase data and the data archive.

Science: I gave an invited review at the “Horizon” meeting on “ASCA PV-phase observations of cataclysmic variables.” In addition, we responded to the referee's comments on 2 ASCA first-round papers on CVs that had been submitted to Publications of the Astronomical Society of Japan (Letters), and resubmitted these (Mukai, Ishida & Osborne on FO Aqr; Ishida, Mukai & Osborne on EX Hya). Both papers have since been accepted. My ASCA AO-1 observation of V834 Cen was carried out in early March but I have not received the data yet. Finally, I submitted one ASCA AO-2 proposal as the PI and participated in several others as co-Is; we are waiting the review results.

Next quarter: The NRA for ASCA AO-3 will be issued; I am planning to attend the summer AAS meeting and an international CV meeting in Italy; I hope to receive, and start the analysis of, the V834 Cen data.

James Lochner
LHEA Office of Guest Investigator Programs
Code 668.0
(Activity 5030-04A-39)

1st Quarter Report, 1994

The first quarter of 1994 showed continued progress in the development of the Guest Observer Facility (GOF) for the X-ray Timing Explorer (XTE). My part in this development during this past quarter continued to concentrate on issues surrounding the All Sky Monitor, the development of new software for OGIP's FTOOLS package, and initiating the organization of the technical appendix for the XTE NASA Research Announcement to be released later this year. In the science domain, I submitted, and as was a part of, a number of proposals in response to the 2nd NRA for ASCA.

This quarter saw the completion of the Interface Control Document (ICD) between the MIT ASM team and the XTE Science Operations Center. Because the GOF plays an important role in receiving and archiving the results from the ASM, the GOF has important contributions to this ICD. I took charge in reviewing, modifying and negotiating the GOF issues contained in this document. Part of this effort included an all day meeting with the author of the document, Dr. Ron Remillard (MIT), and the other scientists in the GOF, Dr. Alan Smale (USRA) and Dr. Arnold Rots (USRA). We discussed the structure of the ASM archive database, scenarios for transfer of the data from MIT to the GOF, and the disposition of the quick-look results generated in the Science Operations Facility. These discussions not only helped to bring the ICD to a successful conclusion, but also clarified many issues.

Subsequent to these discussions, I developed FITS file formats for the data files in the ASM archive database. These formats have been reviewed by OGIP's FITS committee, and we've been given the initially go-ahead to further fill in the details for these formats.

In this past quarter, I developed four new routines for OGIP's FTOOL package. While aimed to initially serve the needs of XTE users, these routines will be applicable to other missions as well. Three of these routines perform simulations of light curves, and are based upon work I have previously done. They may be used in the preparation of proposals to determine the feasibility of detecting sinusoidal variations and shot noise in a particular signal. These signals may be added to existing light curves, or a fake light curve may be created from scratch. The fourth routine encapsulates Scargle's (1982, ApJ, 263, 835) algorithm for performing Fourier analysis on data

with uneven sampling or with multiple data gaps. This capability, not currently supported by existing OGIP software, is useful for all sky monitor data, and for pointed satellite data containing data gaps due to earth occultation and SAA passage. These routines are to be provided for the SOC's Software Build 3 at the end of April. I delivered documentation and a test plan for these routines to the SOC at the end of March.

During this past quarter I also initiated the organization of material for the Technical Appendix of the NASA Research Announcement due to be released this fall. This Appendix gives prospective proposers information about the instruments and their capabilities. The GOF depends upon the XTE instrument teams to provide material for this Appendix. To this end, I presented to the instrument teams a schedule for first and final drafts for these materials, and developed a template document format for them to use. Although the responsibility for putting this material together has been taken over by the newest GOF scientist, Dr. Eric Schlegel (USRA), I will continue to contribute to this effort by reviewing material submitted by the HEXTE and ASM teams.

On the science front, this quarter was occupied with writing proposals for the second proposal cycle for ASCA. I was lead on one proposal, and was Co-I for several others. The proposals in which I was involved is as follows (head PI only is listed):

"A Study of the Iron Line Emission in Scutum X-1", J. C. Lochner

"Circinus X-1: Still Crazy after all these Years ?", L. A. Whitlock (USRA)

"X-ray Nova in Quiescence", C. R. Shrader (USRA)

"X-ray Spectroscopy of the Be/X-ray Binary GX304-1", R. L. Kelley (GSFC)

"Is 4U1907+09 a Non-Aligned Supergiant Rotator?", L. R. Cominsky (Sonoma State Univ.)

Results of the peer review for these proposals will be announced in the coming quarter.

In Jan., Laura Whitlock (USRA) and I submitted to ApJ the paper entitled "Observations of the Small Magellanic Cloud by the Vela 5B X-Ray Monitor". The referee's report was generally favorable, and we shall resubmit this paper in the coming quarter.

My paper with Dr. Diane Roussel-Dupré (Los Alamos), "Recurrence Times and Periodicities in 4U1608-52 as Observed by Vela 5B", was resubmitted in this quarter. The referee's report was favorable, but a few more matters need to be taken care of before publication. We expect to resubmit this work to ApJ in the coming quarter.

In addition to the continuation of the efforts described above, this coming quarter will also include the development of XTE display materials for the upcoming AAS meeting in Minneapolis, and the ADASS and High Energy Astrophysics Meetings this fall.

Universities Space Research Association
High Energy Astrophysics Program
Technical Report
1st Quarter 1994

Arnold H. Rots
Task number: 5030-04A-39

15 April 1994

1 XTE-SOC

1.1 XFF

The "Build 2a" version of XFF was finished, providing the first production version of this system. It was ready before the end-to-end demonstration that the Project had requested of the SOC, providing the link between the SOF subsystems and the GOF Ftools.

XFF documentation was thoroughly updated to reflect the current state, with the addition of a section on the database system and the inclusion of an implementation plan for Build 3. The database section is based on the paper submitted for the ADASS-93 proceedings.

EDS transparent configurations are now supported, while the database handling is made more sophisticated, allowing appending, inserting, and replacing of data.

1.2 DDL

The design of the Data Description Language (DDL) was completed. This mainly involved provisions for PCA event modes.

1.3 FITS Formats

More sets of data descriptors and template FITS files have been produced for various instruments and modes.

A separate document was developed that brings together all the special FITS conventions used in the XTE context. The most contentious issue, at the moment, is XTE's desire to use unsigned integers.

1.4 Time

Various issues surrounding the mission time keeping were settled during this quarter. In connection with that, I delved into all the questions of clock corrections, time systems, relativistic transformations, etc. The current baseline is that XTE will use TT (Terrestrial Time), conformant with IAU decisions, and that the files will contain TT with an absolute accuracy of at least 1 ms. We will maintain sufficient information to do much better than that, with extra effort on the part of the user. "Much better" means: at least one, possibly two, and a slim chance of three, orders of magnitude.

2 Community

The OGIP FITS Working Group has started a review of the XTE FITS conventions.

3 Research

Bill Pence and I have taken up the analysis of the ROSAT data on NGC 1961 again.

4 Travel

I attended the winter meeting of the American Astronomical Society, held in Washington, DC, in January 1994.

5 Next Quarter

During the next quarter I will continue the design of the FITS Data Extractor which will act as a Data Base Management System for the hierarchy of XFF-generated FITS files.

I will further pursue application of the Gregory-Loredo timing analysis algorithm and hope to get a better upper limit on the intra-cluster gas in the NGC 1961 group from our ROSAT observations.

Quarterly Technical Report

Eric M. Schlegel

Activity: 5030-04A-39

This report will cover the period of 1 January to 31 March 1994.

During the above named period, I have been working on a mixture of science and programmatic tasks. These will be outlined below.

Science

A paper describing upper limits on the γ -ray emission from cataclysmic variables (CVs) is nearly complete. A simple estimate indicates that CVs should be γ -ray emitters, largely due to Compton upscattering of ultraviolet photons off non-thermal radio electrons. The predicted fluxes lie above the sensitivity limits of the *Compton* EGRET instrument. No CVs have been detected with the resulting upper limits at least a factor of 5 below the predicted fluxes. The puzzle becomes more convoluted when low-mass X-ray binaries (LMXBs) are included. Various models have been developed over the past decade detailing how LMXBs should be γ -ray sources. Very few LMXBs have been detected by the EGRET instrument. The same team of investigators (E. Schlegel, P. Barrett (USRA), O. deJager (PU, South Africa), and G. Channugam (LSU)) has also acquired the COMPTEL instrument data. Again no CVs are detected. Both investigations are likely to spur additional theoretical work.

The *ROSAT* data on the galaxy NGC 6946 has been re-submitted for publication after the referee's concerns were addressed. The paper was not substantially revised, but the revisions made did require considerable time to make.

One of the resolved sources in NGC 6946 is an extraordinarily bright supernova remnant. An *ApJ Letters* paper has been accepted for publication, probably in the April 1 issue of *ApJ*.

None of the historical supernovae are visible in NGC 6946 and upper limits on the x-ray emission have been assigned. A brief paper is in preparation describing the upper limits. The upper limits paper has required some understanding of Bayesian probability theory. A small program has been written to generate upper limits based upon the total observed counts from the region of a potential source, the number of background counts, and the relative exposure times of the "source" region and the background. The best previous software available made an approximation to the proper relation. Tables using the new software will likely be published as a

separate, brief paper.

A paper is nearing completion describing the results of work done during the summer of 1993 with a student from the University of Maryland. We examined the amateurs' databases on the dwarf novae VW Hyi and Z Cha (both southern hemisphere objects). The databases extend over 40 years, representing more than 10,000 visual observations of these two stars. The data have been analyzed and are presently being digested.

Work has been done to analyze the *ROSAT* PSPC data on SN1978K in NGC 1313. This supernova is behaving quite unlike anything we have seen before, so continued monitoring of it will be necessary. An AO-5 *ROSAT* proposal will be submitted for additional observing time. A paper, describing the observations, is in the early stages of preparation.

Programmatic Tasks

During the above period, two key programmatic tasks were done: preparation for publication of the proceedings of the *ROSAT* Science Symposium, and joining the X-ray Timing Explorer project.

The *ROSAT* Science Symposium was held 8-10 November 1993 at the Adult Education Center of the University of Maryland and sponsored by USRA. Approximately 130 people attended the 3 day meeting which was designed to highlight *ROSAT* science done by US observers. Previous *ROSAT* meetings have been devoted to data analysis issues or have been held in Germany. The proceedings of the symposium will be published by the American Institute of Physics Press. Of a maximum of 107 contributions, only 11 authors have stated that they will not publish their symposium contribution, leaving 96 possible contributions for the proceedings. Each contribution has been read and graded. The grades were assigned on the basis of meeting the size requirements (automatic failure) and typos or grammatical constructions (the author is permitted to fix or not, as (s)he sees fit). Approximately 25% of the papers had to be returned to the authors for correction. The delivery of the manuscript to the publisher merely awaits one or two papers from contributors. The subject index, the source index, and the author index have all been completed.

I joined the X-ray Timing Explorer Guest Observer Facility on 1 February. The prime task will be the generation of the NASA Research Announcement for the first round of proposals for XTE. I have spent the past month or so becoming familiar with the technical details of XTE and the instruments.

Travel

Travel during the report period was completely local. I attended the American Astronomical Society meeting in Crystal City, VA in January. I presented *ROSAT* data on the light curve of supernova 1978K in NGC 1313.

Tasks Planned

The following tasks are planned for the second quarter of 1994.

For science, I intend to work to complete the supernova X-ray review paper I am writing, likely destined for a review journal such as *Reports on Progress in Physics*. In addition, the following papers should be completed during this time: the *ROSAT* PSPC data on the spiral galaxy NGC 6946; the EGRET CV survey; the VW Hyi long-term light curve behavior; the upper limit on the historical supernovae in NGC 6946; and the light curve behavior of SN 1978K. I also will submit proposals to the AO-5 *ROSAT* cycle.

The programmatic tasks on the agenda are the final completion of the proceedings of the *ROSAT* Science Symposium and the preparation of the *XTE* NRA. The due date for a draft of the NRA is 1 July.

Two meetings are on the agenda for attendance: first, the Analysis of Emission Lines meeting to be held at the STScI in mid-May; second, a meeting on cataclysmic variables to be held in June in Italy.

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March 30, 1994

To: Crystal Wheatley, USRA.

Re: Quarterly technical report, 1/1/94 - 3/31/94.

XTE: I began this quarter preparing for the demonstrations to the XTE Project of the software from XTE Build 2, completed at the end of the last quarter. We demonstrated various FTOOLS, using data that came out of the FITS formatter (XFF). One problem was that the formats of the datafiles coming out of XFF had changed since the end of the previous build, so in order to do the demo we in fact had to upgrade the Build 2 software to cope with the new data formats, which took extra time. The second programmatic milestone in January was a presentation describing the interface between the Astrophysics Data Facility (Code 631), the group responsible for doing our archiving and data distribution, and the rest of the SOC. This presentation was made to the XTE Project on January 20th, prior to which many meetings were held to sort out various technical issues. In January, I also designed the XTE proposal forms and presented them to the Science Working Group. Finally, I was involved in finalizing the contents of the Interface Control Document between the GOF and the ASM group at MIT.

In February I turned my attention to the Mission Planning interface between the GOF and the SOF, and put in quite a bit of work on this ICD and the accompanying Data ICD. In March I managed to get some time away from XTE programmatic responsibilities to do some science, but still put in many days work on the hardware and personpower estimates for XTE after launch, on the design and development of the new RPS (remote proposal submission) software, which will make use of the Mosaic WWW server, and several other GOF administration issues. I also spent some time on FTOOLS design and development.

ASCA: This quarter I have been analyzing the PV observations of the X-ray binaries X1820-303, X1822-371, and X1916-053. I presented results from the first of these objects at a meeting in Japan at the beginning of March, and the following is an abstract describing this work:

“X1820–303 is a low-mass binary situated in the core of the globular cluster NGC6624. Its orbital period of 11 minutes is the shortest known of any LMXB, and in addition the system shows QPO and burst behavior. X1820–303 was observed by ASCA on 1993 October 6 05:14 UT for 22 hrs. Although several modes were used, I concentrate here on the GIS PH and SIS FAST datamodes. The deadtime-corrected source flux of 3.7×10^{37} erg s⁻¹ (at 6.4 kpc) indicates that X1820–303 was in a low state during the observation. The 3% orbital modulation of the source was clearly detected in periodogram analysis of the light curve. The 0.6–11 keV GIS2 and GIS3 spectra were fitted simultaneously with various models, and a reasonable fit ($\chi^2=710/426$) was obtained using a combination of Comptonization with $kT_{ee}=3.8 \pm 0.3$ keV and $\tau=12.9 \pm 0.6$, plus a blackbody with $kT_{bb}=0.77 \pm 0.02$ keV, the blackbody making up 13% of the total flux. Iron K emission at 6.7 keV was observed with equivalent width 60 ± 20 eV, the first unambiguous detection of K-line emission in this source. However, a line-like feature observed in the SIS at 1 keV is not confirmed by the GIS, and is probably instrumental or systematic in origin. Phase-selected spectroscopy and a new ephemeris determination are in progress.”

In addition I am involved with analysis of the data from 1E2259+586, a pulsar in a supernova remnant, and the pulsar X1626–67, both as a co-author.

I prepared and submitted three proposals for the next round of ASCA observations: “The abundances and evolution of the globular cluster LMXBs X1746–371, X1850–086, and X0513–401”, “The X-ray dip behavior and burst emission of X1323–619”, and “Spectroscopy of X2127+119/AC211 in the metal-poor globular cluster M15”. I was also a co-I on two others: “Abundance anomalies in the dipper X1755–338” and “The extreme X-ray transient A0538–66”.

Towards the end of March I attended the ASCA AO-2 proposal peer review in the Ritz Carlton at Tysons Corner, Virginia. I was the chair of one of the galactic panels, which meant that I had to assess proposals beforehand, lead and control the panel discussion, and take the main responsibility for coming up with a rank-ordered list to form the backbone of the observing program for the next six months of ASCA observations. The review itself took three very intensive days, while the preparations took several days more.

My proposals were considered in the other panel (i.e. the one I was not chairing), but since I attended the plenary session at the end of the review where conflicts were resolved, I know that four out of the five proposals listed above were awarded observing time on ASCA, which is a very good average considering that overall less than 1/3 of the submitted proposals succeeded in getting time.


Conferences, travel: I attended the “Horizon of X-ray Astronomy – First Results from ASCA meeting at Tokyo Metropolitan University, Tokyo, Japan, at the beginning of March, and presented the work on X1820–303 discussed above. After the meeting I prepared the text which will be published in the Conference Proceedings.

I also traveled to exotic Tysons Corner in faraway Virginia for the ASCA review.

Science: My main effort this quarter was in analyzing the ASCA data described above. Two papers with my name on appeared in *Astrophysical Journal* this quarter: “A Broad Band X-ray Telescope observation of the black whole candidate LMC X–1” by Schlegel et al., and “The complex soft X-ray excess in NGC 4151” by Weaver et al.

During the next quarter I will: continue with my XTE work on FTOOLS and XSELECT through Build 3 and beyond; attend the Minneapolis AAS meeting to present results from ASCA, get up to date with current astronomy research in various fields, and man the first XTE GOF booth; spend considerable time working out policies and issues connected with the research announcement for AO-1 of XTE observations; continue with the analysis of various ASCA observations, and perhaps look at one of the optical observation tapes that is sitting on my shelf.

Please contact me if further
details are required,

A handwritten signature in black ink, appearing to read 'A. Smale', written over a horizontal line.

Dr. Alan P. Smale

USRA REPORT 1/1/94 - 3/31/94
Dr A.B.Giles
Employee Task No: 93-05-00

During the above period Dr Giles continued as the Software Manager for the PCA experiment software development and deliveries to the XTE Science Operations Center. He also continued to support the Goddard team developing the PCA detectors for the XTE satellite.

Meetings:-

Dr Giles regularly attended the following list of meetings at GSFC in connection with the PCA experiment:

PCA software deliveries to SOC (Chair)	alt. Tuesdays
PCA representative on the SOC meetings	alt. Mondays
PCA full team group meeting	every Friday
PCA representative on GOF meetings	occasional

Other specific meetings were:

Instrument Teams (IT)	10 January	STX
3rd Instrument Operations Working Group	27 January	GSFC
XTE Science Working Group (SWG)	27-28 January	GSFC
SOC Health & Safety subsystem review	2 February	STX
Demonstration to Project of Build 2	9 February	STX
SOC Command Generation subsystem review	14 February	STX
Instrument Teams (IT)	28 February	STX
4th Instrument Operations Working Group	1 March	GSFC
SOC Science Monitoring subsystem review	10 March	STX

Conferences:-

Dr Giles attended 4 days of the 183rd meeting of the American Astronomical Society held at Crystal City, DC from 11-15 January.

Travel:-

None

Activities:-

As PCA Software Manager Dr Giles major activity of the period was the preparations and deliveries for the XTE SOC Build 3. All the required documentation was delivered on time and in good shape at the end of March. The software for Build 3 is due at the end of April and most of it is expected to be delivered on time. Some aspects are ahead of schedule and some are behind though overall progress is excellent.

Staff losses within the SOC have continued to impact on the efficiency of the distributed software development program. Recurring systems and integration problems either within the SOC or on the GSFC network round Building 2 have increasingly caused frustrating delays in the first quarter of 1994.

Both the Health & Safety and the Science Monitoring subsystems have had major redesigns which is not exactly desirable this far down the development track. Dr Giles and the PCA team have played an important role in assisting the SOC with these revisions.

The XTE Project Office have become increasingly active in monitoring the progress of the instrument teams. Dr Giles has so far been able to provide them with appropriate progress & planning charts to "keep them happy".

As Software Manager Dr Giles continues to coordinate the work of the following programmers:

Aileen Barry	Hughes STX	INT (moving to GOF support)
Hwa-ja Rhee	Hughes STX	PCA Science Monitoring - SOF
Vikram Savkoor	Hughes STX	PCA Commanding - SOF
Ramesh Ponneganti	Hughes STX	PCA Housekeeping - SOF
Mike Stark	UMD	PCA background modelling - GOF

Dr Giles is the chairman of a search committee which through USRA is assessing candidates for a scientist position on the XTE program in the PCA group.

Documents:-

The following documents have been updated or enhanced:

PCA Housekeeping - Status, Suggested Screen Layout, Recall Modes, SOC Interface, PCA-HK-EXP-V3.1, March 25th 1994, A.B.Giles (76 pages).

PCA Commands - Types, Sequences, Use, Suggested Screen Functions, Configuration Verification, SOC Interface, PCA-COM-EXP-V3.0, January 21st 1994, A.B.Giles (47 pages)

PCA Science Monitoring - Design Concepts, Screen Functions, STD Modes 1 & 2, SOC Interface, PCA-SM-EXP-V3.0, January 18th 1994, A.B.Giles (35 pages)

PCA Telemetry Simulator - Housekeeping generator for PCA & SOC Software Testing, PCA-SIM-EXP-V3.0, March 31st 1994, A.B.Giles (34 pages)

PCA Instrument Description (20 page Draft), written & coordinated by Dr Giles was delivered to the GOF on 3/20/94 as required. This chapter forms part of the XTE NRA which is due out in late November 1994.

The Interface Control Document between the XTE Science Operations Center and the PCA Principal Investigator Team was signed in late February.

Publication Activities:-

Dr Giles continues to work on the Rapid Variability Analysis paper mentioned in previous quarterly reports and some progress has been made. Dr Giles hopes to present a version of this paper at the ADASS conference in Baltimore during September 1994.

Dr Giles is also preparing a paper on XTE to present at the Astronomical Society of Australian annual meeting in Canberra in July 1994.

The PCA group will also be presenting papers at an X-ray conference at Utrecht in August 1994 and at the next AAS meeting in Minneapolis during June 1994.

A multi-author paper, including Dr Giles, describing the complete analysis of all the results of the stellar occultation by Pluto in 1988 finally appeared in Icarus at the end of 1993.

Next Quarter:-

Dr Giles principal activity for the next month will be to continue to support the SOC-PCA delivery schedule for Build 3 plan. He will then be busy defining the Build 4 plan so that all the programmers are efficiently occupied. By the end of Build 4 (October 94) the bulk of the PCA deliveries should have been made.

Quarterly Report: 1 January through 31 March 1994

Weiping Zhang

Introduction

This quarter has seen the most intensive XTE/PCA activities. I have worked in many fronts. In a report of this size I can only give a very brief summary of the most interesting activities that I have been involved in.

Detector Performance Evaluation

It was found during the evaluation process that some of the proportional counters have some finite probability to break down. When the break down happens, the detector gets into a strange mode in which it consumes a lot of electric power but can no longer detect genuine x-rays. There were many meetings held to talk and discuss about this problem. I believe I played the most important role in identifying the problem and in devising the solution which is currently used. The cause of the problem is the quality of the wires used in the counters. I, with the help from many of the engineers and technicians, found that the wires supplied to us by the wire manufacturer have a lot of dust particles embedded in them. These, dust particles, being insulating to electric current, can accumulate electric charges on themselves to such an extent to cause a local electric discharge which, looking from a macroscopic view, looks like a breakdown.

After identifying the cause of the problem, I designed a scanner system to systematically scan every centimeter of the detector wires. I also wrote most of the software needed to process the data collected from the scanner. Now this scanning is part of the standard XTE/PCA detector qualification process.

Calibration and Characterization

This is a continuation of the same activity from last quarter. Using the beam facility on top of Building 2 at GSFC, I have checked into the uniformity of 5 of the 6 XTE/PCA proportional counters. The last one will be checked in the next few weeks. For doing the check, I developed many software tools and give necessary scientific supervision and advice to the technicians involved. In short, we verified the following: (1) Detector gain under vacuum and low temperature; (2) Detector resolution under vacuum and low temperature; (3) Collimator responses; (4) X-ray throughput directions.

Integration and Testing

During the last two weeks of March, we saw the first time that XTE/PCA detectors were integrated with the spacecraft and their data system which is built by a group at MIT. We successfully verified the integrated system.

One particular part in which I played a significant role is the end-end timing test for the entire system. Being a timing experiment, XTE's clock must be verified to the highest accuracy possible. For one reason or another, GRO and EUVE's clocks were off by an embarrassing amount. Thus

we have taken special precaution to make sure that XTE's clock be accurately set. To this end, I devised an independent clock verification procedure which was adopted by the project. Several engineers from HSTX and Fairchild have implemented the procedures and built the necessary equipment. During these two weeks we successfully verified that the XTE clock can be set with an accuracy of about 2 microsecs. I developed much of the necessary software for this test.

Research Activity

Among all the hectic activities I managed to find some time to think about science which is the thing I am interested most. In collaboration with Jean Swank, who is my NASA task originator, I am writing a paper on a new method measuring the neutron star period in low mass x-ray binaries.

Also in collaboration with Ed Morgan of MIT, I am writing a paper on some techniques of doing Fast Fourier analysis.

Also I am preparing to start writing proposals for the XTE/PCA observations. I have had quite a few ideas worked out and need to turn them into some concrete proposals in the next few months.

Quarterly Technical Report
(1 January - 31 March 1994)

Name: Wan Chen
Position: Research Associate
Task Number: 5000-643
Date: 2 May 1994

- Trips: 1. The 183rd AAS Meeting, 11-15 January 1994, Washington D.C. Papers presented [1]-[2].
2. GRO Phase 3 GI collaboration, 14-28 March 1994, Max-Planck Institute for Extraterrestrial Physics, Garching, Germany. A seminar was given at MPE with the title: "(1) Geminga and the Local Bubble, (2) Massive Stars as EGRET sources".

Work accomplished:

- [1] The Physical Implication and Pair Content of the Radio Jets from 1E1740.7-2942, a poster paper presented at the 183rd AAS meeting by Wan Chen, Neil Gehrels and Marvin Leventhal.
- [2] A Systematic and Statistical Study of X-ray Nova Light Curves, a poster paper presented at the 183rd AAS meeting by C.R. Shrader, W. Chen, J.C. Lochner, and M. Livio.
- [3] On the Optical Counterparts, Long-Term Variabilities, Radio Jets and Accretion Sources in 1E 1740.7-2942 and GRS 1758-258, Wan Chen, Neil Gehrels and Marvin Leventhal, accepted for publication in the May 10 issue of ApJ.
- [4] Observation of the Crab-like SNR G74.9+1.2 in the Error Circle of an Unidentified EGRET source, a research proposal submitted to ASCA AO-2 by Neil Gehrels, Wan Chen, Ann Parsons, Rob Petre, John Mattox, and Gottfried Kanbach (Wan Chen wrote the proposal).
- [5] HRI Observations of SNR Coincident with EGRET Sources, a research proposal submitted to ROSAT AO-5, by Wan Chen, John Mattox, Neil Gehrels, Rob Petre, David Thompson, and Gottfried Kanbach.
- [6] Studying the Correlation between the 1.8 MeV Emission of ^{26}Al and the Galactic Spiral Arm Structure Using COMPTEL, a research proposal submitted to Compton GRO Cycle 4, by Wan Chen, Neil Gehrels, Roland Diehl, and Uwe Oberlack.
- [7] Deep Imaging Cygnus OB2 Association region with EGRET, a research proposal submitted to Compton GRO Cycle 4 by Richard L. White and Wan Chen.
- [8] Theory and Observations of Non-thermal Phenomena in Hot Massive Stars, an invited paper to be presented to IAU Symposium "Wolf-Rayet Stars: Binaries, Colliding Winds, Evolution", May 2-6, 1994, Elbar, Italy, by Richard L. White and Wan Chen.

Work in progress and planned for the next quarter:

1. Compilation and classification of all known X-ray nova light curves and a complete review of the current theory and observations of X-ray nova, an ApJ paper in preparation with Chris Shrader, Jim Lochner, and Mario Livio. Preliminary results were presented at the 4th Annual October Astrophysics Conference in Maryland (1993): The Evolution of X-ray Binaries and at the 183rd AAS Meeting in Washington D.C. (1994). This work will also be reported in IAU Symposium "Compact Stars in Binaries" to be held 15-19 August 1994 in Hague, The Netherlands.
2. Understanding the COMPTEL ^{26}Al Map Features Using Galactic Spiral Structure, an ApJ Letter paper in preparation with Neil Gehrels and Roland Diehl.
3. The Bar Structure at the Galactic Center as a Hot Spot in the COMPTEL ^{26}Al Map, an ApJ paper in preparation with Neil Gehrels and Roland Diehl.
4. A New Model of Nonthermal Synchrotron Radio Emission from Massive Stellar Winds, an ApJ paper in preparation with Richard L. White.
5. Understanding the Black Hole X-ray Novae Using Disk Instability Models, an ApJ paper in preparation with John Cannizzo and Mario Livio.
6. Search for 1.8 MeV Emission of ^{26}Al from Nearby Supernova Remnants, an ApJ paper in preparation with Neil Gehrels and Roland Diehl.

From: Dr. Eric R. Christian
NASA/GSFC Mail Code 661

April 15, 1994

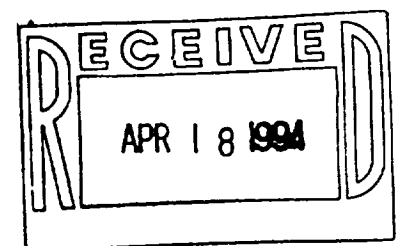
Quarterly Technical Report
1st Quarter, 1994

ALICE (A Large Isotopic Composition Experiment): ALICE is a balloon-borne experiment designed to measure the elemental and isotopic composition of galactic cosmic rays in the charge range Silicon to Nickel between 400 and 800 MeV/nucleon. It is a collaboration with the U. of Siegen in Germany. There is an almost complete refereed paper on the isotopic composition of Silicon and Iron for submission to Astrophysical Journal. Final revisions are due from all co-authors on May 1, at which point I'll submit it. Although I am not first author on this paper, I have been very active in the data analysis, writing and editing of this paper (and am the first US author).

Voyager Cosmic Ray System: I continue to work with Drs. Ed Stone and Alan Cummings of Caltech on a paper for the Astrophysical Journal. The data analysis for this paper is now complete, and the writing of the paper has begun, but has been delayed. Because the solar cycle is once again approaching solar minimum, Dr. Cummings and I are restarting the analysis I did for my thesis and looking for evidence of anomalous cosmic ray hydrogen. The first look at new data looks very good and we will probably present a paper at a conference in June.

IMAX (Isotope Matter-Antimatter eXperiment): IMAX is a balloon experiment which we are working on with Caltech, U. of Siegen, and NMSU to measure the fluxes of anti-protons, and Hydrogen and Helium isotopes over a wide energy range. During this quarter, I have continued to work on the analysis of the data from our successful 1992 flight. I am responsible for the energy loss measurement in four scintillation counters, including mapping and other calibrations and corrections. This work will continue over this entire year. Science results are starting to appear, and some will be presented at the annual meeting of the American Physical Society in April, with the first refereed paper following.

TIGER (Trans-Iron Galactic Element Recorder): TIGER is a balloon experiment designed to look at ultra-heavy galactic cosmic rays. It is a collaboration with Washington U. (St. Louis) and U. of Minnesota. Our counters are ready but due to delays at Wash. U., the flight has been delayed until summer 1995. This project will remain at a low but constant level of effort until full integration next spring.



ISOMAX: This is another magnetic spectrometer balloon experiment in collaboration with Caltech and U. of Siegen. It is specifically designed to look at the isotopic composition of Beryllium, because ^{10}Be is a very important clock that can measure the lifetime of all cosmic rays. Because ^{10}Be is a rare isotope, the experiment is being designed for long duration flights from Antarctica or Greenland, although the first flight in 1995 is planned for Canada. I am responsible for the onboard command and data handling system and the ground support equipment. During this quarter, I the data system design was completed, and we are now beginning construction and programming. In this quarter, I also worked on the design of the ground support data analysis equipment which is mostly complete. I also refined the magnetic shield designs for the upcoming flight.

ACE (Advanced Composition Explorer): ACE is an Explorer that is planned for launch in 1997 to study the solar wind, and heliospheric and low energy galactic cosmic rays. I am the Assistant to the Project Scientist (Jon Ormes). This requires spending considerable amount of time in meetings and facilitating communication between the project management here at Goddard, the spacecraft contractor (the Applied Physics Laboratory), and the experiment teams. I am also on the science team for two of the instruments onboard. During this quarter, the amount of time I've spent working on ACE has increased, and this will continue into the next quarter. I am a member the ACE Mission Operations Working Group and the Spacecraft Operations Working Group, both of which meet monthly. I also attend weekly project meetings and the monthly APL status meeting. During the last quarter, a Preliminary Design Review was held successfully for CRIS and SIS (the two instrument whose science team I'm on). I also attended another Preliminary Design review for the ULEIS experiment. I also completed a first draft of the ACE public relations brochure.

I have also been working with Drs. Dan Baker (NASA/GSFC) and John Cooper (NSSDC) on some theoretical work on solar modulation. We are attempting to gain insight into modulation processes by treating the heliosphere in the same way planetary magnetospheres are treated (which are their specialty). During the last quarter, John and I finished a paper that is being submitted at an April Ulysses conference that, if approved, will end up as a refereed paper. I am first author on this paper.

On top of all this, I am the system manager for the new UNIX computer system the group has bought for use in IMAX and ISOMAX data analysis. As part of this, I am giving a series of lectures to the group on the new software and environment.

29 March 1994

Quarterly technical report of Bradley E. Schaefer

The BATSE detectors continue to send down high quality data on gamma ray bursts. In the last quarter, my activities are the routine work of regular data processing. This includes scientific analysis, data archiving, answering questions to nonBATSE team members, refereeing papers, and writing papers. During the first quarter of 1994, I attended a BATSE Team Meeting at UC San Diego for purposes of discussion on the BATSE cyclotron line search. This featured the results from my exhaustive computerized line search. I am nearing the end of my analysis comparing the BATSE SD spectra with burst spectra from COMPTEL, EGRET, and OSSE, with the results being that (with a few exceptions with the COMPTEL telescope with large error bars) all instruments agree well. The typical scatter is 7% rms, and this is probably a measure of the intrinsic accuracy of spectra.

Over the next quarter, I will continue working with the BATSE software and continue analyzing BATSE data. I have been asked to present colloquia at Bartol (Newark Delaware), UCLA (Los Angeles), NC State (Rayleigh NC), Yale (New Haven), GSFC (Centerwide Science Colloquium), and a special meeting of the Royal Astronomical Society (London). I will travel to La Serena Chile to observe gamma ray burst counterpart candidate fields in June.

TO: David Holdridge/610.3, USRA
FROM: Scott Barthelmy/661
RE: 1st Quarter 1994 Report

13 Apr 1994

This report describes 4 areas of activities: the Gamma Ray Imaging Spectrometer (GRIS), the BACODINE project, the Gamma ray To Optical Transient Experiment (GTOTE), and several miscellaneous activities. My effort was split approximately 10/70/10/10. The activities described below are mine either directly or through the supervision of others. For the GRIS project there is one other scientist whose efforts are in other areas and are not described here. There are no other scientists contributing on the BACODINE project.

GRIS project activities:

Very little was done on the GRIS project this quarter. I did about a week's worth of post-flight data analysis work on the Fall 93 flight so that Lyle Bartlett could include the Crab observation in his thesis. And another few days for the U. of Birmingham, England, piggy-back instrument (SAGE -- the segmented array of Ge detectors).

BACODINE project activities:

The BACODINE project has exploded in scope from its original idea. It turns out many people have instruments capable of making meaningful follow-up observations and are interested in receiving the real-time GRB coordinate locations.

Currently, 11 collaborations at a total of 15 sites around the world with a total of 23 instruments are receiving BACODINE burst positions. Follow-up observations of GRBs based on BACODINE notifications began in earnest this quarter. The most scientifically promising collaboration is the group at LLNL (Hye-Sook Park) with their 53° FOV totally automated CCD system on a fast Contraves mount. One GRB was observed with a 22 sec total time delay to a 7.5 limiting magnitude. Bernie McNamara (UNM) operates a system with the Air Force that has made follow-up observations on 2 bursts with time delays of 16 & 3.7 hours to a limiting magnitude of 16. Kevin Hurley (UC Berkeley) uses the Lick Observatory astrograph and has made a follow-up observation on 1 GRB with a delay of 16.5 hours to 16th mag. The VLBA radio collaboration observed 2 GRBs with delays of about 1 hour with a limiting flux of 40 Janskys. To date, none of these observations has yielded a positive detection. The upper limits at the specified time delays after the GRBs has bettered the previous upper limits by a few magnitudes in the optical bandpass and by more than a factor of 10 in the radio. The European Optical Network (Germany, Czech Republic, Bulgaria) just recently started.

Five additional collaborations will definitely be started next quarter and several other groups have made some initial inquiries which may develop into actual collaborations. The Cal Tech electronically steerable phased-array radio telescope shows great promise in that with a target acquisition time of 1 sec it has the ability to detect the predicted dispersion delayed radio pulse and thereby determine the distance scale to GRB. Currently, the distance scale ranges from just outside our Solar System to cosmological distances of Z greater than a few.

The so called "level 1" version of the coordinates calculation algorithm is implemented and functioning routinely. The U. of Maryland physics grad

student, James Kuyper, is continuing his Fall work this Spring semester. He has been working on miscellaneous operations support programs and will finish the implementation of the code which corrects the position determination for the non-cosine(theta) detector dependencies and the earth atmosphere scattering correction.

I traveled for a week to MSFC in Huntsville, AL, to visit with the BATSE team to learn about non-GRB triggers identification and the details of the scattering correction algorithm.

GTOTE project activities:

This project has resumed a high level of effort. An electronics engineer and two E-techs were assigned to the project. The weather enclosure will be completed next quarter (the weather for outdoor work is getting better again). The CCD camera (the last subsystem to be obtained) will be purchased next quarter. Two scientists (Drs. J. Norris & J. Bonnell) were added to the project to work on the CCD control software and the off-line data analysis software. They started at the very end of this quarter.

GRB Follow-up Proposals:

I invoked my ToO program on the Kitt Peak Schmidt telescope on GRB940217. CCD images of the GRB error box were obtained 36 hours after the GRB. The analysis of the images has not been completed yet.

Talks:

I will be presenting a "Status Report" talk on BACODINE at the Spring APS conference next quarter. The new upper limits will be discussed along with the usual "advertisement" for new collaborations with BACODINE.

USRA Technical Report (1st Quarter, 1994)

Helmut Seifert (Task Number: 660-044)

Task Description:

I have been leading the Transient Gamma-Ray Spectrometer (TGRS) data analysis and Ground Support Equipment software development, and am responsible for writing the software requirements/specifications and documentation. I am furthermore designing and testing the algorithms which are being used by the software. Similar work is done by me also for the KONUS instrument. I am taking an active part in the laboratory testing of the TGRS analog/digital flight electronics and software. I am responsible for formulating and conducting all the instrument tests and calibrations during the integration and calibration phase of TGRS.

Activities:

Upon return my return from annual leave from 1 – 30 January 1994, I worked on the development of the TGRS data analysis software and on preparations for TGRS/WIND flight operations. The former involves regular meetings and discussions with the programmers, the latter the writing of procedures and similar activities. I have also begun with Monte-Carlo simulations of the TGRS instrument. This will be crucial for the interpretation of our measured data in flight.

I will continue with the same activities during the 2nd quarter, and at some point I also will be present for the mechanical and electrical integration of the TGRS instrument on the WIND spacecraft, and for some tests of yet undetermined scope at Martin-Marietta. The WIND launch has now been shifted to November 1994.

UNIVERSITIES SPACE RESEARCH ASSOCIATION
GODDARD VISITING SCIENTIST PROGRAM

QUARTERLY TECHNICAL REPORT- First quarter of 1994 - 3/10/94

Employee Name: John W. Mitchell Task Number: 660-018

During the past quarter my primary activities were development work for the new ISOMAX balloon program, analysis of the 1992 IMAX flight, preparations for the WiZard 1994 balloon campaign, analysis of data from accelerator experiments, and development work on new flight and ground based experiments. Also, during the past quarter, I had two new papers accepted for publication.

ISOMAX - Isotope Magnet Experiment: I am Instrument Manager for ISOMAX, which is being developed by GSFC, Caltech, and the University of Siegen (Germany). In this capacity, during the last quarter, I worked on a variety of experiment issues including instrument configuration, electronics, power, and structure.

The instrument is based on a new large superconducting magnet. I am directly responsible for the magnet, and during the past quarter the bids for the magnet construction were received. I worked on evaluating these bids.

I am also responsible for the time-of-flight system and the experiment electronics, including development of new low-power flight systems. During the past quarter I worked on hardware for the low power electronics, in particular a charge-sensitive amplifier system for use with the Cherenkov detectors.

I participated in an ISOMAX collaboration meeting at Caltech in 3/94. At this meeting I gave a number of presentations on ISOMAX development issues.

ISOMAX activities will occupy most of my time during the next quarter.

IMAX (Isotope Matter-Antimatter eXperiment) - This instrument was built and flown by GSFC, Caltech, NMSU, and the University of Siegen (Germany).

I am working directly with two graduate students, Wolfgang Menn and Olaf Reimer, at the University of Siegen, Germany, analyzing the IMAX TOF and aerogel Cherenkov detectors. This work will continue during the next quarter. In addition, the collaboration is beginning to move from detector analysis to physics analysis. I expect to be heavily involved in that process.

During 3/94 I participated in an IMAX collaboration meeting at Caltech (in conjunction with the ISOMAX meeting. At this meeting the state of the analysis was reviewed and plans were made for the next phase.

Also during the past quarter, an article on the IMAX tracking system, on which I am a coauthor was accepted by Nuclear Instruments and Methods. Abstracts for three IMAX papers were submitted to the APS for presentation at the spring meeting in 4/94. I will be giving the primary instrument paper.

MASS/WiZard: The WiZard-Related Balloon Program is conducted by an international collaboration with researchers from the U.S. (NMSU and GSFC), Italy, Germany, Sweden, India, and Russia. During the past quarter I participated in preparations for a flight to take place in summer, 1994. My efforts centered on the time-of-flight system and on the electronics.

In addition, I participated in a WiZard collaboration meeting held at NMSU during 3/94. At this meeting I gave a presentation on the development/refurbishment of the MASS II gas Cherenkov detector.

SMILI (Superconducting Magnet Instrument for Light Isotopes): The SMILI instrument flew twice: in August, 1989, and in August, 1991. During the past quarter analysis continued on data from both flights.

E878 (ANTD): This is a program of experiments at the Brookhaven National Laboratory Alternating Gradient Synchrotron (AGS) to obtain the heavy-ion-collision production spectrum of pions, kaons and antiprotons in the energy range from 1.5 GeV to 24 GeV. E878 will also conduct a high statistics search for the production of antideuterons or exotic particles in this energy range.

During the past quarter, I participated in analysis of E878 data. In addition, I participated in an analysis meeting at Brookhaven National Laboratory in 1/94.

An initial discussion of the 1992 E878 results was published in Nuclear Physics in 1/94. In addition, a description of the strange particle (strangelet) search was published in the January, 1994 issue of Scientific American (H. J. Crawford and C. H. Greiner, "The Search for Strange Matter"). The lead photograph in this article features the E878 Cherenkov detectors, including the aerogel Cherenkov detectors that I built.

Abstracts for two E878 papers were submitted to the APS for presentation at the spring meeting in 4/94.

Experiments E683H and E849H: The results from E683H are now being prepared for publication. The publication has reached a near-final draft stage and it is expected that it will be submitted to the Physical Review during the next quarter.

Experiment E938H (Transport Collaboration): During the past quarter, I participated in the analysis effort and in other collaboration activities. In particular, I directed a post-doctoral researcher from the University of Catania, Sicily, Jan Romanski, in improving the calculations of the particle flight times. I also worked on modeling the instrument acceptance as one of the final steps in preparing for publication. Work will continue in both of these areas during the next quarter. I participated in an analysis meeting for E938H at Lawrence Berkeley Laboratory in 2/94.

An E938H paper giving the results on charge-changing cross sections was accepted for publication by the Physical Review in 3/94. Three additional papers are in preparation.

TIGER - Trans-Iron Galactic Element Recorder: This experiment is conducted by a collaboration between Washington University, the University of Minnesota and GSFC. During the past quarter, I worked on TOF system development and testing as well as in general experiment planning. I also worked on the experiment electronics.

E896 (H0): During the past quarter I participated in preparing a proposal for a new accelerator experiment which will conduct a high sensitivity search for the H0 hyperon. This effort included a meeting at Lawrence Berkeley Laboratory in 3/94.

The H0 is a six quark bag (uuddss) that is predicted to be produced in great numbers in heavy-ion central collisions. However, it has a short lifetime and has not been detected as yet. The proposed experiment will conduct the most sensitive search to date for this

particle. The experiment was proposed to the Program Advisory Committee (PAC) of the Brookhaven National Laboratory Alternating Gradient Synchrotron (AGS) in 3/94 and was accepted. This is one of the first completely new experiments to be accepted by the AGS in some time.

I will have overall responsibility for the experiment electronics, including the fast event trigger, and for the high-rate beam detector system.

I will also participate in the development of a second level (software or hardware) trigger. This will be an extremely complex system capable of performing pattern recognition on a 10,000 cell drift chamber tracking system (DDC). A complete accept/reject trigger decision must be made in less than 100 μ s and it is expected that the trigger will incorporate a massively parallel architecture. This architecture may form the basis for the trigger to be used in an upcoming experiment at the new BNL Relativistic Heavy-Ion Collider (RHIC). My particular interest in the second level trigger is in developing fast (few μ s decision time) hardware-based pattern recognition techniques.

In addition, I will have a part in development of the critical Distributed Drift Chamber (DDC).

POEMS (POsitrone Electron Magnet Spectrometer) - This is an experiment to measure the cosmic ray electron and positron flux, using a magnetic spectrometer technique. POEMS was accepted for phase B development as a Small Explorer. The silicon strip detector hodoscopes are to be built by GSFC. During the past quarter, I participated in a number of POEMS collaboration activities.

New Satellite Experiments: During the past quarter I worked on the conceptual development of three new experiments which may be proposed in response to the upcoming USRA satellite AO or the new Fast Sat program. These experiments will be closely tied to university collaborations.

In addition, I worked on the development of three possible satellite experiments to be performed by international collaborations.

Quarterly Report for Brenda L. Dingus
01/94-03/94
Activity: 5030-12A-39

Proposals Submitted:

ROSAT AO-5 "X-Ray Observations of Unidentified EGRET Gamma-Ray Sources Located Off the Galactic Plane"

CoI: Greg Madejski (USRA/GSFC) & Matt Malkan (UCLA)

GRO Cycle 4 "Analysis of Gamma-Ray Bursts Detected by EGRET"

CoI: EGRET Team (GSFC/ Stanford/ MPE), Alice Harding (NASA/GSFC),
Kevin Hurley (UC Berkeley), Chryssa Kouveliotou (USRA/Huntsville),
G. Fishman (NASA/MSFC)

CoI on 8 other EGRET Team proposals

Presentations Made:

"EGRET Observations of Galactic Latitudes $-30 < b < -10$ "
AAS, Crystal City

"EGRET Observations of GRB940217 and GRB940301"
LHEA, Seminar

Presentation to attract graduate students to work with the EGRET team
University of Maryland

Papers in Progress:

"EGRET Observations of Galactic Latitudes $-30 < b < -10$ "

"Delayed, High Energy Emission from Gamma-Ray Bursts"

Lab Work:

Completed design of time projection chamber.
Further perfected track fitting algorithm for drift chambers.
Attempted xenon reclamation and purification.

University Collaborations:

University of Maryland - 2 graduate students to begin work this summer. One student has passed the qualifier and is interested in doing her thesis on EGRET data.

MILAGRO - MILAGRO is a ground based TeV gamma-ray detector that is a collaborative effort of University of Maryland, UC Irvine, UC Santa Cruz, and Los Alamos National Laboratory. I've recently joined the collaboration and plan to spend a week in Los Alamos this summer. I also helped write a GRO Cycle 4 proposal entitled "Optimization of the MILAGRO Telescope using EGRET Data".

□

Dr. Joseph A. Esposito
Technical Report
Period: 01/94-03/94

Research:

My laboratory work on the Advanced Gamma-ray Astronomy Telescope Experiment (AGATE) has continued. The AGATE anti-coincidence dome refurbishment nears completion. Creation of Monte Carlo simulation programs to determine candidate calorimeter materials has been started. Both of these tasks will be completed by the end of next quarter.

Analysis of EGRET data has proceeded. Comparisons of unidentified EGRET galactic plane sources with the known positions of supernova remnants with radio emission greater than 100Jy has yielded 5-6 candidate sources with high statistical significance. Work is continuing on a supernova remnant paper in parallel with the data analysis. I have also performed analysis on two viewing periods, vp0312 and vp0313, which are both Virgo deep survey pointings. My work on giant molecular clouds is continuing with combined phase I and II analysis of the Taurus cloud. A paper on this topic should be completed next quarter.

I have submitted a Compton GRO Phase IV proposal to study the gamma ray emission from luminous infrared galaxies. My co-investigator, Dr. Giovanni Fazio, and I are hoping for acceptance of this proposal due to the lack of knowledge pertaining to these extragalactic sources. We have requested two instrument pointings (NGC 0253 and Arp 220) together with previous archive data. According to current estimates the summed data set, Phases I-IV, should yield a direct measure of the NGC 0253 gamma ray flux with roughly 3-4 sigma confidence.

Likelihood Programming Support:

I have completed my current programming support of the EGRET likelihood analysis software. I anticipate a need to debug problems with the code which arise during the next quarter as the software begins to be used for analysis. I will complete documenting (programmers development document and users guide) the software during the next quarter. I am also writing software which expands on the current point source analysis to permit analysis of diffuse or extended objects (e.g. supernova remnants).

Presentations:

I submitted one contributed oral presentation, "Observation of Gamma Ray Emission from Gould's Belt", at the January AAS meeting in Crystal City, VA.

Publications:

I am co-author on several significant publications which have been submitted or accepted including:

- " The First EGRET Source Catalog", Fichtel et al., 1994, accepted by Ap.J. suppl.
- " A Study of M31, M87, NGC 253, and M82 in High Energy Gamma Rays", Sreekumar et al., 1994, accepted by Ap.J.
- " The Likelihood Analysis of EGRET Data", Mattox et l., 1994, submitted to Ap.J. on 3/19/94

05/03/94

P.Sreekumar
Activity: 5030-12A-39

The routine reduction of data from the EGRET instrument on the Compton Gamma Ray Observatory continues and during the last quarter, I have been primarily assisting the team to carry out the analysis. In addition, my routine responsibilities include helping out with overseeing the manual editing of spark chamber events on screens, creating the summary database and the exposure history database for each viewing period. A quick look skymap of the region is made along with the exposure and intensity maps to examine the presence of any new, interesting or unexpected source of high energy radiation. This is necessary to inform Guest investigators and multiwavelength community.

A significant part of my time was spent examining the high energy gamma ray emission from the North Galactic Pole region using observations carried out by EGRET during Phase I and II. The results will be published as one of a series of papers by the EGRET team in the Astrophysical Journal this summer.

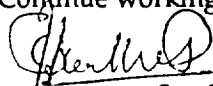
Presented a poster paper at the AAS meeting in Washington DC (January 12-15) 1994. The paper discussed preliminary results on the extragalactic diffuse emission. The observed flux above 100 MeV was found to be consistent with the early results from SAS-2, but the spectrum was found to be harder. This is very important result from the point of view of modeling the extragalactic radiation as contributions from unresolved sources. Additional work on examining the instrumental background (if any) dependence on orbital phase, etc are continuing. Since we have decided to revise our selection criterion on the Earth albedo events, all the data is currently being reprocessed for diffuse analysis. Work on the corresponding paper is in progress.

Meetings attended:

AAS meeting in January, 1994, Washington DC: presented poster paper
APS meeting, April, 1994, Washington DC:

Future Work:

1. Complete the North Galactic Pole analysis and the paper..
2. Continue working on the extragalactic diffuse radiation


Parameswaran Sreekumar

Quarterly Technical Report for 1 January 1994 to 31 March 1994

James A. Miller, Code 665, (301)286-3642

In the period from 1 January to 31 March 1994, I was involved in three projects concerning particle acceleration in astrophysical sites. First, I considered stochastic gyroresonant ion acceleration by cascading Alfvén wave turbulence. Most of the applications of this work are to solar flare particle acceleration, but it also has implications for acceleration in black hole accretion disks. The basic model is that Alfvén waves are generated at long wavelengths through, for example, a shear flow instability occurring in magnetic reconnection. These waves cannot resonant with background ions due to their small wavenumbers, but will cascade nonlinearly through wavenumber space to larger wavenumbers. When the wavenumber of the cascading waves becomes large enough, they will at that point be able to cyclotron resonate with the background ions, accelerating them out of the Maxwellian distribution to large (relativistic) energies. This process is described by two coupled, nonlinear, partial differential equations: the quasilinear equation for the particle spectrum, and the diffusion equation for the wave spectral density. Coupling between the two equations is provided by the damping of the waves by the ions. I have constructed a quasilinear code to solve this system, and have obtained results which are now in the process of being written up for publication in the *Astrophysical Journal*. Essentially, I find that cascading Alfvén waves are capable of energizing enough ions out of the background distribution to account for gamma-ray line emission from typical solar flares.

The second project is the investigation of the nonlinear Landau damping of two parallel Alfvén waves by a hybrid plasma simulation. The analytical work on this mechanism is already complete, and we wish to compare those results with the results from a full simulation of the plasma. This work is being done in collaboration with Adolfo Vinas in Code 692. While the results are still preliminary, we find discrepancies with the analytical theory. We are now in the process of determining the cause of the deviations.

In the third project, begun with Chuck Dermer at NRL, we are looking into the problem of stochastic acceleration in black hole magnetospheres, along with the accompanying radiation processes. A paper on the preliminary work will be completed and submitted before the end of May. We have also just submitted a Compton GRO Guest Investigator proposal requesting funds to further study the problem.

In the next quarter, I plan to complete the work on cascading Alfvén waves, start researching electron acceleration by the accompanying fast mode (magnetosonic) waves, and also begin looking into the problem of DC electric field electron acceleration.

□

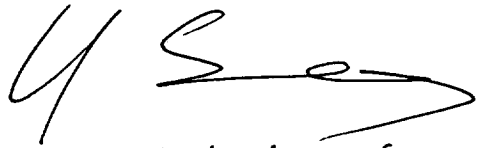
To: Ms. Crystal C. Wheatley, USRA
From: Yang Soong, LHEA Code 666, Bldg. 2, Rm 271, X66318
Date: April 12, 1994
Subject: Technical Report for 1/1 - 3/31, 1994

We are carrying out research which was part of the center DDF proposal. The improvements of the image of the thin foil X-ray mirror with the newly established replication process has been verified. A step forward in implementing the technique to the next generation X-ray telescope is well underway. Another proposal for lab development in the next three years to the NASA/HQ was also funded with the level at \$75k for mirror research. We will be thinking and planning for mirror development beyond year 2000.

The Astro-E, a US-Japan collaboration which will be a successor of the current ASCA satellite, is in negotiation. We, the Goddard group, will be providing X-ray mirrors, focal point detector, and the analysis system, if we come to an agreement. The need for manpower is urgent. There is a hiring announcement in the April 9th AAS job register posted by USRA.

ASCA data analysis is underway. We are sharing the PV phase data among the PI groups. I am working on the Galactic binary X-ray emitters, such as Her X-1, Vela X-1, 4U0614+091, etc. The spectral data is superior to that of the previous missions due to the excellent energy resolution of the CCD detector. The spatial resolution matched our expectation with the ground testing results.

These activities have been supported by the task # 5030-14A-39.


April 13, 94

QUARTERLY REPORT TO USRA FOR THE PERIOD
1st January 1994 – 31st March 1994

Tahir Yaqoob

TASK No. 93-15-00; EMPLOYEE ID: 05-05 96800

Following is an outline of accomplishments this period. I will deal with each project in turn.

Papers Accepted For Publication

The following papers, were accepted for publication in the *Publications of the Astronomical Society of Japan*:

- (i) The Complex X-ray Spectra Of Two High Redshift Quasars Observed With ASCA (Serlemitsos *et al.*)
- (ii) The X-ray Emission of 3C 273 Observed With ASCA (Yaqoob *et al.*).

This work has been described in previous reports.

International Symposium 'New Horizon In X-ray Astronomy', Japan

In march I attended the international symposium entitled '*New Horizons in X-ray Astronomy*' held at the Tokyo Metropolitan University, Japan. The purpose was primarily to exhibit new results from the Japanese/US X-ray astronomy mission, *ASCA*, after the first year since the launch. Since the instruments aboard this mission represent significant advances upon previous X-ray detectors, the first year of the mission has produced many new and exciting results.

Invited Talk

I was invited to give a talk at the above conference which was a review of the results of all the quasars observed during the Performance and Verification (PV) phase of *ASCA*. The talk is now in the process of being written up to be published in the symposium proceedings.

Poster Paper

I also presented a poster paper at the above symposium, on a different topic to the talk. The subject of the poster was concerned with the interpretation of recent results from *ROSAT* for a sizable sample of active galaxies (AGN). In the poster, I proposed a theoretical interpretation of a correlation found from the *ROSAT* data between the X-ray spectral shape in the *ROSAT* passband and the strength of the so-called 'big blue bump' at UV to soft X-ray energies.

All the preparatory work for the symposium (invited talk and poster paper) was done in this report period.

Analysis of ASCA Data

The Performance & Verification phase (PV) of the Japanese/US X-ray astronomy satellite, *ASCA*, began in March 1993 and has been producing a large quantity of new data. I have been analysing data from many of these observations but below will describe below some of the projects which have received the most attention in the period covered by this report.

The Nature of the X-ray Emission in the Quasar PG1211+143

Work was begun on writing up the analysis results for the *ASCA* PV observation of the quasar PG1211+143, which will eventually be submitted for publication in the *Publications of the Astronomical Society of Japan*. The observation provides new information on this source which helps to constrain the mechanism of X-ray production in the central engine of the quasar. Evidence is found for rapid amplitude variability of the X-ray flux whilst the spectral shape remains steady.

Rapid X-ray Spectral Variability in NGC 3227

Analysis of the *ASCA* PV data on this Seyfert galaxy is in progress. The data reveal surprising new results which could not have been derived from instruments flown on previous X-ray astronomy missions. It is found that *both* the luminosity and spectral shape are rapidly variable on a timescale of about 20,000 s. Most of the variability can be attributed to variability of the soft X-ray flux whilst the harder X-ray flux remains relatively steady. Evidence is also found for the first time for two absorption edges due to ionized Oxygen. Work is in progress on interpreting the implications of these results on the physical conditions and structure of the active nucleus in this most interesting Seyfert galaxy.

ASCA and ROSAT proposals

Four proposals were written and submitted to observe targets in the AO-2 Guest Observer phase of *ASCA*. Two of the targets were high redshift quasars while the other two targets were Seyfert galaxies which are expected to show interesting spectral features in the *ASCA* band. A proposal was also written to observe two targets with the *ROSAT* High Resolution Imager (HRI). Both targets are spiral galaxies which are thought to harbor 'hidden' active nuclei. Deep exposures with the HRI will be used to address this hypothesis.

ASCA Review

The *ASCA* peer review to select successful proposals for the AO-2 Guest Observer phase was held in March. I served as a panel member which involved reviewing some ~ 40 proposals.

IDL Analysis Tools

More routines to facilitate and advance the analysis of *ASCA* data were written in IDL as well as updating routines already written.

WORK PLANNED FOR NEXT QUARTER

In the next quarter the analysis of *ASCA* data and work on papers documenting the results will continue, for the sources mentioned here and new targets.

March 31, 1994

**Quarterly technical report for Grzegorz (Greg) Madejski,
working under USRA contract no. NAS5-30442 to
NASA/Goddard Space Flight Center for the quarter
ending March 31, 1994**

My activities continue to include both independent research (X-ray emission from AGN and BL Lacs) and programmatic work (the X-ray Spectrometer).

1. The X-ray Spectrometer.

My primary responsibility at the lab is the work on the X-ray Spectrometer (XRS) instrument.

The X-ray Spectrometer project has recently undergone a significant change in scope. As a result of the congressional mandate related to the NASA budget revisions, the AXAF-S spacecraft -- the original vehicle which was to be used to deliver the XRS into orbit -- has been cancelled. However, the congressional budget mandated that the development of the instrument should continue, with the intent to fly it on a Japanese mission ASTRO-E.

The ASTRO series of satellites (which included the highly successful Astro-C, or Ginga, and Astro-D, or Asca), is devoted to study of X-rays from celestial objects, and is administered by the Japanese Ministry of Education. The Japanese organization responsible for the implementation of the satellites is Institute for Space and Astronautical Science, or ISAS, in Sagamihara, near Tokyo. ISAS often collaborates with other nations in the development of the payloads for their satellites, and, in fact, Asca featured mirrors developed by Dr. Peter Serlemitsos at the Goddard's Lab for High Energy Astrophysics, and built at Goddard.

ISAS developed the concept for ASTRO-E in 1993, before the incorporation of the XRS into it, and as a result, the total payload dimensions and weights were approximately known for some time. In order to make the XRS compatible with the Japanese spacecraft, many changes had to be made to the instrument design; most notably, the weight, physical dimension and power consumption had to be reduced to fit the desired constraints. Nonetheless, the basic concept of the XRS remains unchanged : it will be a sensitive X-ray spectrometer, devoted to high resolution spectroscopy of celestial X-ray sources, placed behind a high-throughput X-ray mirror. The XRS would be one of several instruments on ASTRO-E. One of the main activities of the entire XRS team at Goddard during the last quarter was the "resizing" of the instrument to fit the constraints of ASTRO-E. Furthermore,

NASA and ISAS agreed that the mirror, used to focus the X-rays on the XRS detector, would be built and developed at Goddard as well.

While the XRS detectors will be basically the same as planned for AXAF-S, the main change to the instrument would be a different, lighter cryogenic subsystem. (The cryogenic subsystem is necessary to maintain the detectors at their operating temperature of 0.1 K.) The redesigned cryogenic subsystem now includes a two-stage dewar, with the outer dewar using solid cryogen (most likely solid neon), and inner dewar, using superfluid helium. That is in contrast to the original AXAF-S design, where a single-stage dewar was to be used, with superfluid helium. Despite the substantially lower instrument weight and volume, the predicted cryogen lifetime was kept to 3 years, only slightly less than that for AXAF-S. In March 1994, we travelled to Japan to participate in discussions related to how the instrument fits into the expected ASTRO-E concept, and the constraints that the satellite and the instrument impose on each other.

2. Astrophysical Research.

A number of projects were completed in the last quarter, and new projects were initiated. Projects completed or substantially advanced in the 1st quarter of 1993 are :

- Analysis of the data for the multiwavelength campaign for BL Lac object PKS2155-304 has been completed. The third paper, reporting the ROSAT data, is now in press in *Astronomy and Astrophysics* (Brinkman *et al.*). The third paper, cross-correlation between the optical, UV, and X-ray data, is also in press in *Ap. J.* (Edelson *et al.*); a preprint is enclosed.
- Analysis of the X-ray spectral data for BL Lac object AO 0235+164 (Strong X-ray absorption as compared against the radio 21 cm data indicates abundances of heavy elements twice of our own Galaxy) is in press (*Ap.J.*, Sep. 10, 1994); as soon as a Goddard preprint is available, I will forward it.
- Analysis of the simultaneous X-ray and gamma-ray spectral data for Seyfert 1 galaxy IC4329A has been completed. The observational paper by Madejski *et al.* has been resubmitted to *Ap.J. Letters*, with changes requested by the referee. The companion theoretical paper by Zdziarski *et al.* is complete, and has just been sent to *Ap.J. Letters*.
- Analysis of the BBXRT data for BL Lac object PKS2155-304; the paper is now accepted (Madejski *et al.*), and undergoing revisions.
- Joint IUE/EUVE observations of AGN (Greg Madejski's IUE grant, with Drs. Carone, Marshall, Porter, and Urry) is now being written up for publication (Carone *et al.*).

• Multi-wavelength campaign to observe OVV blazar 3C279 (with Drs. Urry, Maraschi, and Wehrle); the first paper (Overall spectral variability by Maraschi *et al.*) is undergoing revisions, and should be submitted to *Ap.J. Letters* in ~ 4 weeks. Subsequent papers are in preparation.

• Study of reprocessing in Seyfert I galaxy NGC 6814 (with Drs. Czerny, Loska, and Cukierska of Copernicus Center, Warsaw, Poland) has been received back from the *Ap. J. Letters* referees, and accepted pending revisions; it will be resubmitted in ~ 1 week.

• Identification of the periodic source in the field of NGC 6814 (with Drs. Watson, Done, Rosen, and Osborne of Leicester University) is being written for publication in the *Monthly Notices of R.A.S.*

Accepted proposals (as a PI):

• ASCA : (1) Spectrum of Mkn 335 (with Drs. Zdziarski and Turner); (2) Spectrum of BL Lac object AO 0235+164 (with Drs. Hartman and Kallman); (3) X-ray spectra of BAL quasars (with Drs. Begelman, Voit, DeKool, Sikora, and Kallman).

• ROSAT : Rapid variability of BL Lac objects PKS 2155-304 and Mkn 421

Submitted proposals (as a PI):

2 for Asca observing time, 2 for ROSAT observing time, and 2 for GRO observing time.

Technical report for Michael Loewenstein, 1/1/94-3/31/94

My paper entitled "Implications for Gravitational Lensing and the Dark Matter Content in Clusters of Galaxies from Spatially Resolved X-ray Spectra", submitted last August was accepted for publication in the August 10, 1994 *Astrophysical Journal*, and has been distributed in preprint form.

I am a co-author (along with numerous other Japanese and American X-ray astronomers) of two first-round ASCA papers to be published in a special edition of the *Publications of the Astronomical Society of Japan*: "ASCA observations of three bright early-type galaxies, NGC 4472, NGC 4406, and NGC 4636", and "Discovery of an Obscured Low Luminosity Active Nucleus in the Spiral Galaxy NGC 4258".

I am continuing to analyze ROSAT observations of low luminosity early type galaxies as part of a project in conjunction with Dr. R. Petre to study these objects in X-rays. Preliminary results on the galaxies NGC 3607 and NGC 4697 were presented at the AAS meeting in Washington D.C. in January and at the "New Horizon of X-ray Astronomy" meeting in Tokyo in March.

I also attended software and science working group meetings during the course of the Tokyo meeting, and met both long-distance/unmet and prospective future collaborators.

I wrote two ASCA AO-2 proposals as PI ("X-ray Emission Mechanisms and the Gasdynamical State in Low Luminosity Early-type Galaxies" and "The Nature of the X-ray Emission in NGC 3607"), wrote another as Co-I, ("ASCA Observations of 3 Bright Elliptical Galaxies"), and am a Co-I on a fourth proposal being submitted from the Japanese side. I am also PI on a ROSAT HRI AO-5 proposal entitled "Discrete X-ray Sources in NGC 4697".

I am currently reviewing two *ApJ* papers and one grant proposal to the Israel Science Foundation, writing up my contribution to the Tokyo meeting proceedings, and continuing work on ROSAT and ASCA data modeling and interpretation.

Report of activity for the period January - March 1994 – Ivan HUBENY

During this period, I have continued my work on non-LTE model stellar atmospheres including effect of millions spectral lines (the so-called non-LTE line blanketing), mostly in collaboration with Dr. T. Lanz. We have submitted to the *Astrophysical Journal* first two papers of series entitled NLTE Line Blanketed Model Atmospheres of Hot Stars; the first one describing our hybrid complete-linearization/accelerated Lambda iteration (CL/ALI) scheme; and the second one about models atmospheres for hot, metal-rich DA white dwarfs.

I have collaborated with the group of Dr. J. Holberg (University of Arizona, Tucson). We have discovered the presence of nickel in the atmospheres of hot DA white dwarfs, which were originally thought to be completely free of any traces of metals. Using NLTE model atmospheres computed by Dr. T. Lanz and myself using our program mentioned above, we have determined the abundances of iron and nickel in two hot DA white dwarfs. The results were submitted to the *Ap.J. Letters*.

I have collaborated with Dr. A. Linnell (University of Washington, Seattle) on developing an universal spectrum synthesis program for binary stars. The first paper describing our program was submitted to the *Astrophysical Journal*.

I have collaborated with the group of Dr. J. Cassinelli of University of Wisconsin in Madison, and two other groups (University of California, Berkeley; and University of Oxford, UK), on theoretical interpretation of the EUVE spectra of the brightest object seen in the EUV region, the early B star ϵ CMa. A paper describing our first results has been submitted to the *Astrophysical Journal*.

Trips accomplished:

- i) January 12 - 15, Washington, DC, 183rd meeting of AAS.
- ii) January 27 - February 4, University of California, Los Angeles, Collaboration with Dr. M. Plavec on model atmospheres and accretion disks for selected symbiotic systems and cataclysmic variables.

Papers submitted:

Holberg, J.B., Hubeny, I., Barstow, M.A., Lanz, T., Sion, E.M., Tweedy, R.W., 1994, "The Discovery of Ni V in the photospheres of the hot DA white dwarfs RE 2214-492 and G191 B2B", *Astrophys. J. Letters* (in press).

Linnell, A.P., Hubeny, I., 1994, "A Spectrum Synthesis Program for Binary Stars", *Astrophys. J.* submitted.

Hubeny, I., Lanz, T., 1994, "NLTE Line Blanketed Model Atmospheres of Hot Stars: I. Hybrid Complete Linearization/Accelerated Lambda Iteration Method", *Astrophys. J.* submitted.

Lanz, T., Hubeny, I., 1994, "NLTE Line Blanketed Model Atmospheres of Hot Stars: II. Hot, Metal-Rich White Dwarfs", *Astrophys. J.* submitted.

Cassinelli, J.P., Cohen, D.H., MacFarlane, J.J., Drew, J.E., Lynas-Gray, A., Hoare, M.G., Vallergera, J.V., Welsh, B.Y., Vedder, P.W., Hubeny, I., Lanz, T. 1994, "EUVE Spectroscopy of ϵ CMa (B2 II) from 70 Å to 730 Å", *Astrophys. J.* submitted.

:

My plans for the next three months include:

i) I will continue the work on NLTE line blanketed model atmospheres, in collaboration with Dr. T. Lanz. We will work on Paper III of our NLTE line blanketed model series, namely on models for hot subdwarfs.

ii) I will continue my work in theoretical analysis of hot stars, in collaboration with Drs. Sally Heap, T. Lanz, and A. de Koter. We have recently obtained the first post-servicing mission GHRS spectra of two hot stars, members of the R136 cluster of 30 Doradus in the Large Magellanic Cloud, and intend to publish their preliminary analysis shortly.

iii) I will collaborate with Dr. Werner Schmutz (Zurich) on modeling winds of early-type stars. During my visit in Zurich in April, we concentrate on an analysis on HST spectra of several Of/WN stars.

iv) I was asked to give an invited talk on Physics of Massive Hot Stars in the Special Session of the 184th AAS meeting in Minneapolis, entitled Massive Hot Stars with the Hubble Space Telescope. I am also going to prepare several poster papers for this meeting.

v) I will continue to give a series of lectures entitled "GHRS Short Course on Stellar Atmospheres" for all interested employees of Goddard (Codes 680 and 660).

Travel plans:

i) April 15 - 30, ETH Zurich, Switzerland. Collaboration with Dr. Werner Schmutz on modeling winds of early-type stars and analysing HST spectra of several Of/WN stars.

ii) May 28 - June 2, Minneapolis, MN, 184th meeting of AAS.

Return-Path: <barrett@piglet.gsfc.nasa.gov>
Date: Fri, 15 Apr 94 14:13:52 -0400
To: cwheat@renzo.usra.edu
Subject: Quarterly Technical Report

TECHNICAL REPORT - 1st QUARTER 1994

(1 January - 31 March 1994)

Name: Paul Barrett
Activity: 5030-20A-39

I. SUMMARY

A. Task Work

There are 178 lines left (13%) : press <space> for more, or 'q'1. SAS-2 FITS files and FADMAP program.

Work on the analysis program FADMAP was completed at the end of February. Much of this program had to be rewritten to accommodate the use of FITS files and the XANADU Programming Interface routines. Work began on the testing of this program during March and by the end of March, the program was used to create maps of the COS-B and SAS-2 data to be made available to the public on the HEASARC's Legacy computer.

The transferring of the SAS-2 data from 9-track magnetic tape to 8mm DAT tape is halfway complete. It is hoped that this project will be completed soon.

Several small projects associated with the COS-B and SAS-2 data should be completed during the 2 Qtr 1994.

2. ADP Proposal

A proposal to build an object-oriented software system to analyze data was submitted. Associated with this proposal, investigations into the Hierarchical Data Format (HDF) was made. This proposal was not accepted.

3. GROSSC Tasks

a. NRA Preparations

Work continued with preparation for the next CGRO NRA (cycle 4), including supervision of the remote proposal submission (RPS) software along with Chris Shrader. The RPS software was completed in mid-March and testing has done since that time. This work will be completed by April 11th, the CGRO submission deadline.

b. Publication Database

Began work on developing a list of publications about the Compton Gamma-Ray Observatory and related gamma-ray issues. This database will be publicly accessible using the GRONews account at the GROSSC. An attempt will be made to make it as complete and current as possible. A preliminary version of the database is currently being used internally by the GROSSC. It is anticipated that a working version of the database and access software will be available by the end of the next quarter (1994 Qtr 2).

c. Article for book on "Databases & On-Line Data in Astronomy"

An article is being prepared for a book entitled "Databases & On-Line Data in Astronomy". The article will give a summary of the Compton Gamma-Ray Observatory mission, the contents of the GROSSC archive and the support for data analysis at the GROSSC.

d. OSSE Sensitivity Program

Some work has begun on a program to estimate the OSSE sensitivity to various astronomical sources. It is anticipated that more time will be spent on this project during the next quarter.

e. Air and Space Museum Poster Design

I assisted with the design of a poster intended for display at the Air and Space Museum beginning the latter part of 1994.

f. Workstation System Administration

Several days during January and February were spent on enhancing my workstation and reconfiguring the operating system. This was necessary as a result of my move from Building 2 to Building 1.

4. USRA Business

- a. Attended the USRA Council Meeting in early January.

B. Research

1. ASCA NRA 2 Proposals

Submitted 4 proposals for ASCA NRA, Cycle 2, with the following titles: "ASCA Spectral Studies of the Unusual Intermediate Polar TV Col", "ASCA Spectral Studies of AE Aqr", "ASCA Observations of HEAO-1 Discovered Intermediate Polars", and "ASCA Observations of ROSAT Discovered Intermediate Polars". I should hear the results of the proposal review sometime during the 2 Qtr of 1994.

2. ROSAT NRA 5 Proposals

Submitted 4 proposals for the ROSAT NRA, Cycle 5, with myself as PI. There are and having the following titles: "Observations of Probable Intermediate Polars", "Precessing the Disk in TV Col", "Observations of AE Aquarii: A Low-Powered Analog of Cyg X-3", and "The Period-Gappers: RE J0531-461 and RE J1938-462". Along with D. Buckley as PI and myself as Co-I, 2 other proposals were submitted having the titles: "X-Ray Light Curves of RX J0929-2404: The Longest Period

Eclipsing Polar", Missing Links in Magnetic CVs: The Intermediate Systems RX0515+011 and 1H1752+081", and "Temporal Study of the Multi-Periodic Intermediate Polar TX Col".

3. TV Col Data Analysis

Some analysis work of this Cataclysmic Variable was done during the first half of 1 Qtr. Preliminary results were presented in the ROSAT proposal of the same object.

4. Compton/EGRET Data Analysis of Cataclysmic Variables

Work has continued on a more detailed analysis of the EGRET data of Cataclysmic Variables. Some of this work was presented in a poster paper at the AAS Meeting in Washington, DC. in January 1994. Two papers concerning this data analysis are still in preparation.

3. AAS Meeting

I attend the 1994 January meeting of the AAS and presented a poster paper summarizing our results to date concerning EGRET observations of Cataclysmic Variables.

4. Compton/COMPTEL & OSSE Data.

I visited the Univ of New Hampshire during the second week of February to gain access to COMPTEL data and to understand its data analysis system. Much more work still needs to be done.

5. Software Development

Some time was spent on learning about Object-Oriented Programming and the C++ Programming Language in anticipation of a software development project with other members of the OGIP.

II. FUTURE WORK AND RESEARCH

A. Task Work

1. COS-B and SAS-2 Documentation.

Documentation for the COS-B and SAS-2 data will be completed. The documentation includes: a discussion of the COS-B and SAS-2 data restoration and a User's Guide to the FADMAP program.

2. Compton GRO Publication Database

Preparation is underway for building a GRO Publication database. It is anticipated that much use of NASA's RECON database will be made.

3. OSSE Sensitivity Program

More attention will be given to a program to estimate the OSSE sensitivity to astronomical sources.

4. Compton GRO NRA, Cycle 4, Peer Review

Further assistance will be given to the Compton GRO NRA Peer Review. The proposal deadline for submission is 1994 April 11. This work will involve classifying proposals and reviewing them for technical merit.

B. Research

2. Cataclysmic Variable Research

Work on two papers about gamma-rays from Cataclysmic Variables will continue during the 2nd quarter of 1994 as well as analyzing the other data obtained from my overseas observing trip. It is hoped that these papers will be submitted during this time period.

3. Analysis of ROSAT Data of TV Columbae

It is anticipated that some time will be spent further analyzing ROSAT data of TV Col in preparation for its presentation at a meeting about Cataclysmic Variables in Italy in late June.

III. MEETINGS AND SYMPOSIA ATTENDED

1994 January 12-15: 183rd Meeting of the American Astronomical Society in Washington, D.C. A poster paper was presented.

JERRY BONNELL:

activity 5030-20A-39 : grossc at gsfc

Quarterly Report for Period March 1 - March 31, 1994

performed ...

- assisted in the preparation of materials for a gro display at the national air and space museum. this work is on going.
- prepared version 1.0 of the Compton GRO Science Support Center users' guide.
- performed time domain and spectroscopic analysis of gamma-ray bursts and support duties for the search for optical burst counterparts in accordance with on going research projects.

planned ...

- continue work as directed on gro display at national air and space museum.
- produce updated version of users' guide.
- participate in organization of gro proposal review
- assist in preparation of materials for nasa hq white paper presentation for gro project.
- continue research activities

□

Quarterly report for Dr. Mark H. Finger

March 1 (Date of hire) - March 31
#93-20-00

Part of my duties as BATSE instrument specialist include oversight of the production of archival data products. Weekly meetings are being held with myself, Bob Wilson, Mike McCollough, and the programming staff to review problems with production and FITS related programming. The DISCLA and CONT FITS file production is now in full swing. In March I delivered to the science support center for archiving FITS formatted CONT and DISCLA data covering the 218 day interval TJD 8369-8586. In addition, the key BATSE burst data analysis programs, BFITS, DRM_GEN and WINGSPAN were delivered to the science support center for installation.

My research involves the study of the long term behavior of x-ray binary pulsars using the BATSE hard x-ray data. I am interested studying accretion processes through observation of the torque and luminosity history of x-ray binaries, and statistical characterization of fluctuations in their pulse shapes.

In February and March of 1994 a Giant outburst of the x-ray binary A0535+262 occurred. Using my previously determined orbit I was able to determine the history of the accretion induced torque during the outburst. Power spectral studies I conducted showed a significant aperiodic variability in the hard x-ray flux with a concentration of power in a wide peaked feature. I am presently working on comparing the torque history with the history of the power spectral peak's center frequency. Assuming the Beat Frequency Model for the power spectral feature, this comparison determines the neutron stars magnetic moment, and potentially provides a test for disc accretion theories. I submitted a Compton GRO guest investigation proposal to pursue this investigation in more depth.

In March the transient x-ray binary 4U 1145-619 outburst. I conducted a timing analysis to determine its period history during the outburst. Results of this analysis were included in IAUC 5955, which I was a coauthor on.

In March the x-ray binary GRO J1008-57 reappeared. This source was discovered by CGRO in an outburst in 1993 July. I lead an investigation of the outburst and reported the results in IAUC 5959.

Plans for the 2nd Quarter:

The original BATSE commitment was to deliver data one year after collection. Production has however yet to catch up to this goal. In the next few months archival data deliveries for CONT and DISCLA data will be made that bring them up to one year after collection. Production of the Low level pulsar FITS files are now in full swing. I hope by July to deliver to the SSC at least the first year of data. Production of Epoch folded pulsar profile files has restarted after the correction of several problems. A substantial delivery of this data type is also expected. Delivery of the 2nd BATSE Burst catalog should occur in May or June. I am attempting to encourage Alan Harmon to release occultation source histories for archiving, but to date have had no success.

I am a coinvestigator on a Compton G.I. key proposal on pulsar analysis using BATSE data. The proposal was selected for three years in phase 3. In April I will be working on a progress report for this proposal.

I plan to determine a occultation flux history for the giant A0535+26 outburst and write up the current observations from the outburst as a journal paper.

In May I expect to be working on improvements to the monitor used to detect pulse sources from the incoming BATSE data. After the improvements are made a search through the data for the entire mission will be made for previously undetected sources.

Michiel Bergen, a graduate student of Michiel van der Klis will be visiting MSFC in May. I plan to work with him on epoch folding data for Vela X-1. At the same time I will be working on a new technique for the determination of the power spectral of pulse phases. This technique will be applied to Vela X-1 and Cen X-3. I have been invited to Amsterdam by Michiel van der Klis to work on our study of Vela X-1 and Cen X-3. This will at the end of the summer.

In June I will attend the Compton G.I. peer review.

□

TECHNICAL REPORTS FOR PERIOD 1/94-3/94

Daryl Macomb

+++++

I began working for USRA on the Gamma-Ray Observatory Science Support Center contract on March 2, 1994. The following describes the most important activities I have taken part in during the subsequent period.

Was a co-investigator on 4 GRO proposals, one ROSAT proposal, and PI on one ASCA proposal. The x-ray proposals are for further studies of the BATSE/GRO discovered x-ray binary GRO J1008-57. The GRO proposals are all for EGRET time and involve further studies of MRK 421 and new approaches to determining the nature of some of the unidentified galactic plane sources.

Continued to work on an archival EGRET data analysis project to place upper limits on transient gamma-ray emission from several x-ray binaries - mainly those which have been claimed to be seen at TeV energies. I submitted an abstract to the Minneapolis AAS meeting to give some results on the analysis of a x-ray binaries with EGRET concentrating on Vela X-1, Cen X-3, and Her X-1, all of which are claimed as TeV sources. EGRET can provide important limits in terms of both steady and transient emission from these purported gamma-ray sources.

Made some revisions to a paper entitled "An EXOSAT Detection of GRO J1008-57" which was just accepted for publication in The Astrophysical Journal. Co-authors are C. Shrader (USRA/GROSSC) and A. Schultz (CSC/STSCI).

Made some preliminary studies into the applicability of incoherent summation of power density spectra for searching for pulsars using low count-rate data

Worked with the Goddard graphics people (code 253) on preparing a Gamma-ray burst poster for distribution to a general audience.

Made lists of GRO targets which have been viewed in earlier mission phases and which are being carried over for phase 4 available to the general community. This was intended to help proposers understand what objects have already been studied and which were still scheduleable. I also responded to several email inquiries about these lists.

Took part in the efforts to check in and categorize all phase 4 GRO proposals.

Performed some final testing on the EGRET PointExpose program before releasing it to the general public. In addition, I have spent some time working with the newest version of the LIKE program.

□

Dr. John Mattox
Quarterly Report
#93-20-00

During the first quarter, I wrote ~126 E-mail message in support of EGRET guest investigator activities, and made or received ~30 phone calls. I wrote a paper on likelihood analysis of EGRET data, and 3 cycle 4 EGRET proposals. I was a co-I on an additional ~6 proposals. For the second quarter, I plan to continue my GI support, and research activities.

□

Thomas McGlynn--Quarterly Report 2-Mar-1994 to 31-Mar-1994

Activities:

McGlynn continued to develop the SkyView system for display of all-sky data. A test survey incorporating all ROSAT pointed observations was included in SkyView on March 28. McGlynn continued to direct the activities of K. Scollick in developing software for the SkyView user interface.

McGlynn continued his research into the gamma-ray emission from clusters of galaxies using EGRET data.

McGlynn gave technical direction to activities of the COSSC software staff.

- assisted in the development of FITS data from OSSE Pulsar data.
- assisted in the definition of new FITS data types for EGRET data.
- helped define the requirements for a coherent archive pipeline.
- worked on network problems at the COSSC.

McGlynn worked with the OGIP FITS committee to review FITS formats.

McGlynn prepared EGRET data for distribution on the first GRO CD ROM. This included developing IDL FITS converters for EGRET data.

McGlynn helped approximately 5 users by phone and 15 by E-mail in using the GRO archive and catalog.

McGlynn assisted in the development of the COSSC User's Guide document.

McGlynn worked on the preparation of proposals to the CGRO and NASA CAN proposal solicitations.

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Quarterly Progress Report for Chris R. Shrader, USRA/CGRO -SSC (Activities for March 2-31, 1994)

CGRO Guest Investigator Program: A large amount of effort was made during the reporting period in preparation for the Cycle-4 CGRO Guest Investigator proposals, due on April 11, 1994. In an effort coordinated with other branches of the OGIP, software for the electronic submission of proposal forms was modified, and tested for use with CGRO. A version of this package was installed on the GRONEWS online bulletin board facility. Numerous questions from guest investigators were addressed. A schedule for the submission of CGRO proposals by "in house" USRA and LHEA employees was developed and circulated. Plans for a peer-review meeting were finalized and a site inspection performed.

Guest Investigator inquiries, too numerous to list, were handled. Subjects included instrumentation technical details, program policies and procedures and the planned proposal evaluation process.

Project Support: A meeting was held with members of the National Air and Space Museum (NASM) staff to discuss details for a proposed CGRO exhibit. Based on this meeting and numerous other communications, a detailed proposal for such an exhibit was developed and presented to NASM. It will be evaluated by the museum board during April.

Extensive preparation was made for a presentation to NASA Headquarters requesting an extended (i.e. beyond 1996) of the CGRO mission. A "White Paper", summarizing scientific achievements of the mission to date and presenting a case for future potential was drafted and circulated among the CGRO Instrument Principle Investigators and Project Scientist for review.

A draft of a paper on the CGRO mission status and summary of scientific results was developed. This paper will be submitted for inclusion in several conference proceedings at which the CGRO Project Scientist made presentations.

The SSC participated in CGRO Operations Working Group meeting during March. Various issues, including propellant management, solar panel and battery degradation, and use of the recently implemented Gro Remote Tracking System (GTRS) were discussed.

CGRO-SSC Group Leader Activities: An effort to fill the recently vacated OSSE Instrument Specialist position was initiated in coordination with USRA management. A job announcement was circulated, and a plan for the review of candidates was made. Several preliminary interviews were conducted.

Several internal organizational meetings were held to coordinate the various ongoing activities.

Scientific Research: Proposals two NASA Guest Investigator Programs were prepared during the reporting period. A proposal to observe the transient x-ray binary source GRO J1008-57 with ROSAT High Resolution Imager was made. The goal is to positively identify the optical counterpart to the x-ray source. There are at least two, possibly three candidates within the existing x-ray error circles.

Two CGRO Guest Investigator proposals were developed for submission during April.

Final referee's comments on a paper submitted to the Astrophysical Journal were addressed, and the paper was accepted for publication. A separate paper was also submitted during March.

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J. GREGORY STACY
Quarterly Technical Report
#93-20-00

INSTRUMENT SPECIALIST GI-SUPPORT PROGRAM:

MEETINGS AND PRESENTATIONS:

Greg participates in weekly meetings at UNH related to instrument operation and performance, COMPASS software development, and the scientific analysis of COMPTEL data. He also maintains regular contact with colleagues at the SSC at the GSFC. Greg attended and participated in a COMPTEL team meeting at UNH from 21-25 February; there he reported on the status of GI-related activities to the COMPTEL collaboration. He was also a member of the review panel for the selection of CGRO Compton Fellowships for the coming year. Greg continues to prepare the COMPTEL contribution to the CGRO fortnightly science report, on behalf of the collaboration.

GI CONTACTS AND VISITS:

Greg continues to have regular contact with COMPTEL Guest Investigators, as do other COMPTEL team members, at UNH and in Europe. A list of recent GI contacts and visits, to the various COMPTEL sites, includes the following. To UNH: P. Barrett (GSFC), P. Haskins and E. MacKissoon (Florida), E. Frederick (N.E. Science Ctr), T. Vestrand (UNH), H. de Brunner (Bern), M. Elvis (CfA), M. Maisack (Tuebingen), G. Madejski (GSFC), W. Chen (GSFC), B. McNamara (NMSU), UC/Riverside group. To MPE: M. Maisack (Tuebingen), A. Iyudin (Moscow), V. Dogiel (Moscow), W. Brinkmann and L. Norci (MPE), W. Chen (GSFC). To ESA/ESTEC: R. Buccheri (Palermo), A. Carraminana (Mexico), L. Hanlon and K. O'Flaherty (Dublin and ESTEC). To SRON/Leiden: C. Dupraz (Meudon), M. van der Klis and J. Van Paradijs (Amsterdam), A. Bykov (St. Petersburg).

DATA ARCHIVE AND DATA ACCESS FOR GIS:

The COMPTEL team forwarded to the SSC during this quarter low-level and first high-level data products from Viewing Periods 23-28, for inclusion in the CGRO public archive. The collaboration is in the process of preparing for release to the archive COMPTEL data products for the balance of Phase 1.

At its most recent team meeting the COMPTEL collaboration agreed to release to the CGRO SSC the COMPASS data-analysis software package. Discussions are underway regarding the details of the installation at the SSC.

With R. Freuder of UNH Greg is creating a database of COMPTEL GI information using the ORACLE database manager. With the assistance of D. Serlemitsos and D. Macomb of the SSC, the relevant GI information has now been transferred to UNH.

COMPUTER HARDWARE AND SOFTWARE FOR GI SUPPORT:

With Tom Milliman of UNH Greg continues to maintain the GI workstation area at UNH. The GI DECStation (=yak.unh.edu), an X-terminal, and/or a SUN-clone machine are usually available for GI use at UNH. Greg prepared a COMPTEL "exposure-calculator" tool for the on-line GRNEWS bulletin board, to assist GIs in proposal preparation and archival data searches.

Greg continues to draft, as time permits, an introductory COMPTEL data-analysis and COMPASS users' guide, both for on-site GI use at UNH, and for remote logins from the SSC.

SCIENTIFIC RESEARCH:

Greg is a co-investigator on an accepted NASA ADP proposal to analyze COBE data. Greg (with T. Vestrand, UNH) continues his observations of gamma-ray AGN with the Haystack radio telescope. Greg still has a proposal pending to conduct VLBI observations of a small sample of gamma-ray AGN. He is also involved in a number of ongoing projects with the COMPTEL team, and with other GIs on COMPTEL and EGRET proposals submitted for Cycle 4. Greg continues his collaboration with colleagues at both the Harvard-Smithsonian Center for Astrophysics and with the CGRO/EGRET team at Goddard Space Flight Center on several ongoing research projects. He also continues, with the assistance of graduate students at UNH, his Monte Carlo simulation study of the COMPTEL detector response.

TASKS FOR THE UPCOMING QUARTER:

Among his primary tasks for the upcoming quarter Greg will oversee the delivery of COMPTEL data to the CGRO archive for the balance of Phase 1. He will also oversee and coordinate the delivery of the COMPASS data-analysis package to the CGRO SSC; and he will complete, and distribute for comment, a first draft of an introductory COMPASS users' guide for GIs. As always, he will continue to coordinate all guest-investigator activities for COMPTEL. Finally, he will maintain progress on the various scientific investigations outlined above.

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